Ministry of Health of the Republic of Belarus,
Educational Establishment “Vitebsk State
Order of Peoples’ Friendship Medical University”

Work Book
in Human Anatomy
Locomotion apparatus

Допущено Министерством образования Республики Беларусь
в качестве учебного пособия для иностранных студентов
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The work book is intended for clinically oriented study of human musculoskeletal system anatomy. It contains assessing criteria of students' competence and exam questions. The work book was completed by accordance with the program on Human Anatomy for medical students, studying the specialty 1 79 01 01 (General Medicine) (Minsk, 2014). It is a teaching aid supplementary to textbooks and atlases.

The book is intended for medical students.

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Preface

The Department of Anatomy lays the foundation for special knowledge for a doctor of any speciality. The proposed book is intended for the 1st - year students studying in speciality 1-79 01 01 (General Medicine) as an auxiliary teaching aid in studying human anatomy. The subject "human anatomy" is the most difficult for the 1st - year students, because its study requires a systematic independent work of the student. An instructor is a consultant that guides the student's cognitive interest in the right direction. Therefore, we offer such a guide, following our recommendations will make it easier for you to obtain detailed knowledge about the structure of a human body.

The structure of the workshop corresponds to the schedule of laboratry classes. In the description of each topic, there is given an objective defined, a motivational justification for studying the topic, a list of basic questions, methodological recommendations for studying the topic with the emphasis on the topic and, if necessary, a detailed description of the structural features of the organs studied. For each topic, 25 test questions are proposed for checking the quality of self-training and for self-monitoring of the studied material, as well as several clinically oriented situational tasks. The answers to test questions and situational tasks are given at the end of the workshop before the literature index. In test questions for recognizing the studied structures, illustrations from publicly available teaching aids are proposed, which does not infringe on the copyrights of the creators of the illustrations, but advertises these publications as textbooks.

In each topic, the pages of obligatory and additional literature are indicated, where you can get information on the topics. For convenience, the reference on the topic is given under numbers in the full list at the end of the workshop (For example: 1. from. 23-28. It means that the material on this topic is presented in the first Volume of the textbook "Human anatomy": for medical students: in 2 vol. Vol. 1: edited by M. R. Sapin. – Moscow: New Wave Publishing Agency, 2018 on pages 23-28). The appendix presents "Criteria for assessing the results of educational activities of students in the discipline "Human Anatomy "for the specialty 1-79 01 01 I stage of higher education" and "exam questions from the section" Anatomy of the Musculoskeletal system".

We express our gratitude to the colleagues – - teachers of the VSMU, who provided assistance in compiling the workshop. The authors are grateful to experts Prof. V.V. Rudenko and Associate Professor V.N. Zhdanovich for suggestions that have improved the design of the workbook. We hope that the proposed publication will be useful for students. The authors will gratefully accept the comments of instructors and students aimed at improving this book.

Introduction

Human Anatomy is a fundamental medical science aimes at training future doctors to start their study with. By studying anatomy, you can create a holistic view of the structure of the body of a healthy person. Studying the development and age-related characteristics of organs and systems of the body will let you understand the occurrence of numerous structural options and developmental anomalies. Without knowledge of human anatomy, it is impossible to study a single medical specialty (surgery, therapy, gynecology, neurology, etc.).

You will study human anatomy for 3 semesters. In the first semester, the anatomy of the musculoskeletal system is traditionally studied:

1. Bones, 2. Joints, 3. Muscles.

Anatomy is taught in the form of lectures and laboratory exercises. Lecture plans and laboratory classes are posted on the information boards of departments, on the pages of departments in the distance learning website. The lecture material contains questions about the general laws of the structure and the functioning of body systems, the development of organs, causes and stages of the formation of anomalies and malformations. Having familiarized themselves with the contents in a printed (electronic) collection before attending a lecture, students, listening to the lecturer, receive clarifications on the most difficult issues of clinically oriented anatomy.

In laboratory classes, students study in detail the anatomy of all organs and parts of the human body on anatomical preparations. The materials of the lecture course and laboratory studies are not duplicated, but complement each other.

After studying each of the sections of human anatomy, students demonstrate their knowledge, abilities and skills of anatomical preparations in the final assessment class (colloquium). At the end of the first and second semesters, students take semester tests. At the end of the third semester, students pass the exam.

The most effective algorithm for studying human anatomy at a medical university is as:

1. Preparation for the next laboratory class on the topic set by the instructor at the follows class.

1.1. Reading the guidelines for the topic of the class in this workshop. Learning the purpose and motivation for studying the topic.

1.2. At the extracurricular time reading the appropriate section in the textbook;

1.3. Reading the topic material in the textbook, writing out all new Latin terms and their translation into the working vocabulary list;

1.4. Considering all the drawings on the topic of the class in the textbook and atlases (pages are indicated in the index of the literature to the topic);

1.5. At the Department of Human Anatomy, reading the appropriate section of the textbook, finding each anatomical formation in the atlas drawing, and then finding this formation on the anatomical preparation. This is best managed with one or two colleagues. During unsupervised work, each student can get advice from the teacher on duty.

2. Analysis of unclear questions and practically significant structural features in the classroom with the teacher.

3. Work in the class with anatomical preparations after the teacher's explanation and the revision of key questions on the topic of the workshop.

The structure of human organs can be studied only with anatomical preparations, and not just by reading about them in a textbook and reviewing in the atlas. At each lesson, to assess knowledge, the teacher conducts an oral survey of the students on theoretical material with a demonstration of practical skills.

For self-assessment, students can use the test questions offered for each topic. To understand the significance of the anatomical formations studied in each topic, 2-3 clinically oriented situational tasks are proposed for students to solve independently after studying the material of the corresponding topic.

Thus, for the subsequent use of knowledge about the structure of man in the study of clinical disciplines and in practice, you need to:

1) learn how to find individual organs and anatomical formations in X-ray, tomograms of body parts (decipher X-ray, tomograms);

2) answer the questions of training and progress tests in all sections of anatomy;

3) to master the practical skills recommended by the department in the process of studying the anatomy of all systems of the human body;

4) to solve the situational problems proposed at the end of each topic of the workshop.

Topic 1 Organization of educational process on the Human

Anatomy department. Anatomical position. Planes, axes, lines, region of human body. Anatomical terminology. Bones. Classification of bones

Aim of the class: to understand the issues and order of studying the human anatomy, organization of educational process; to visit and look through expositions of the museums; to get the summarized knowledge about the basic methods of preparation (dissection), preserving and using the anatomical specimens; to study the basic (principal) anatomical terms, axes, planes and regions of the human body; to study the structure and classification of bones.

Motivational characteristics of the topics

The acquisition (gaining) of the study technique about anatomy, university opportunities, safety rules and deontology in the anatomical classes is necessary to start training. Understanding the general plan of a human structure, the basics of anatomical terminology is necessary for the subsequent study of the particular anatomy of body systems.

Main issues of the topic

1. Anatomical preparations are the remains of a dead person, so they require a careful, respectful attitude.
2. The presence of students in the department of human anatomy requires compliance with certain rules and regulations (safety precautions, deontology, dress code).
3. All anatomical formations of a human body have approved international names (anatomical terminology).
4. All correlative terms (such as superior and inferior, anterior and posterior, etc.) should indicate the position of a part (organ) in a human body at the anatomical position, not at its position at the moment.
5. Demonstration of the planes (horizontal, frontal, sagittal) on a skeleton, anatomical models and your body. Demonstration of movements of human body's parts around axis (frontal, sagittal, vertical).
6. Parts of the human body (trunk, neck, head, limbs), their subdivisions and regions.
7. Skeleton and its parts (axial, appendicular).
8. Classification of bones according to their location and structure.

Information section and recommendations on unsupervised activites

1. Take into consideration the meaning and significance of the Human Anatomy as a discipline in the medical education system using materials of Lecture № 1 and the textbook.

2. Characterise the basic methods of studying the structure of a human body using materials of Lecture №1 and the textbook.
3. Read the information about anatomical terminology in lecture №1 and the textbook. International anatomical terminology is of great importance for the understanding of specialists in different fields of medicine in different countries. It contains the names of organs, body parts and structures in Latin.
4. Write down the Latin terms in the student's vocabulary list and memorize them.

№	English term	Latin term
1	abdomen	abdomen, abdominal cavity
2	angulus	angle
3	anterior	anterior
4	apophysis	apophysis
5	arcus	arch
6	articularis	articular
7	articulatio	joint
8	canalis	canal
9	caput	head
10	caudalis	tail
11	cervix	neck
12	corpus	body
13	cranialis	cranial
14	crista	crest
15	diaphysis	diaphysis
16	dexter	right
17	distalis	distal
18	dorsalis	dorsal
19	epiphysis	epiphysis
20	externus	external
21	extremitas	end
22	facies	surface
23	foramen	foramen
24	fovea	fossa
25	frontalis	frontal
26	horizontalis	horizontal
27	incisura	notch
28	inferior	inferior
29	internus	internal
30	lateralis	lateral
31	margo	border
32	medialis	medial

33	medianus	median
34	medius	middle
35	membra	limbs
36	membrum	limb
37	metaphysic	metaphysis
38	os	bone
39	pelvis	pelvis
40	periosteum	periosteum
41	posterior	posterior
42	processus	process
43	profundus	profundus
44	proximalis	proximal
45	sagittalis	sagittal
46	sinister	left
47	skeleton	skeleton
48	spina	spine
49	spinosus	spinous
50	sulcus	groove
51	superficialis	superficialis
52	superior	superior
53	thorax	thorax
54	transversus	transverse
55	truncus	trunk
56	tuber	tuber
57	tuberculum	tubercle
58	tuberositas	tuberosity
59	ventralis	abdominal
60	verticalis	vertical

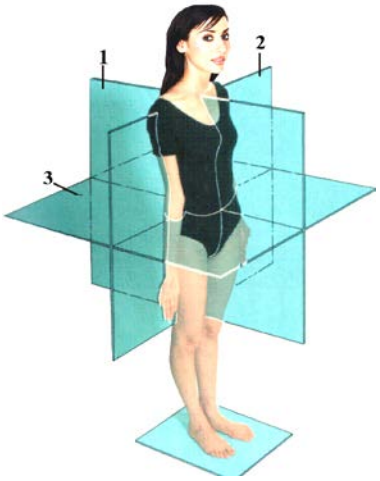
5. Consider that when describing parts of the human body, it is important to use common terminology related to such parts because the human body can be placed in numerous positions. Each position has the potential to change the definition of terms. In the fields of anatomy and medicine all terms refer to the body when it is in the anatomic position. The anatomic position is the position of the body when one is standing up with the feet parallel and flat to the floor, and the upper limbs are at the sides of the body with the palms of the hands facing forward (anterior). In this position, none of two bones of the body crosses each other. The anatomic position is similar to the natural position of an individual when standing up, except for the position of the wrist and hand. Because the position of the wrist and hand is somewhat unusual in the anatomic position, always be extracareful when using directional terms related to the upper limbs.

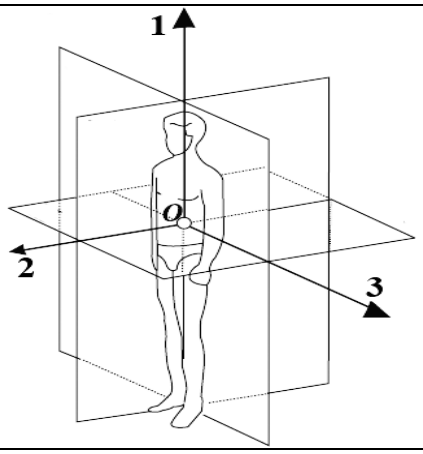
6. Remember and show the basic parts of a human body: head, neck, trunk, upper and lower limbs; find on the trunk: thorax, abdomen, pelvis, back; on the upper limb: arm, forearm, hand; on the lower limb: thigh, leg, foot.
7. Study the classification of skeleton bones and find out features of the structure of tubular bones, spongy or trabecular bones, flat bones, mixed bones and pneumatized bones.
8. Find the diaphysis, proximal and distal epiphyses, metaphysis of the tubular bones.
9. Find the following formations on the bones: fossa, groove, notch, process, condyle, eminence, tuber, tuberosity, tubercle, crest.
10. Find the compact and spongy substances, marrow cavity, lamellae on the cross section of the bone.
11. Define the anatomical formations that make an axial skeleton formed by the vertebral column, the thoracic cage and the skull. Identify the formations of the additional skeleton formed by bones of upper and lower limbs.
12. Write down the Latin terms in the student's vocabulary list and memorize them.
Visuals: skeleton, bones, museum preparations, X-rays, human tomograms in the museum of the department, model of a human's body (glass woman).

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Indicate the most complete definition of human anatomy as a subject:
    1. It is biological science about the structure of a human body.
    2. It is a science about the development of a human body.
    3. It is a science about a form and structure, an origin and development of a human body.
    4. It is a science about a structure and functions of a human body.
    5. It is a science about an origin, macro- and a microscopic structure, age features and functions of a human body.
2. All of the following principles of studying a human body are inherent in modern anatomy:
    1. Principle of unity of the theory and practice.
    2. Principle of integrity of an organism.
    3. Principle of compliance of structure and function.
    4. Principle of unity of an organism and environment.
    5. Principle of compliance of structure and arrangement.
3. What approaches are used in modern anatomy to study a human body?
    1. Evolutionally-anatomical.
    2. Theoretically-philosophical.
    3. Functionally-anatomical.
    4. Phylogenetic.
    5. Practical.

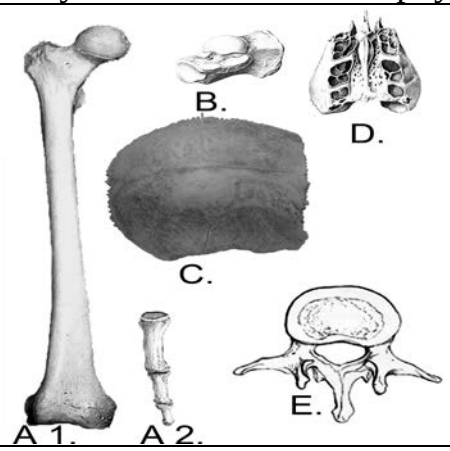
4. Methods to study anatomy used on a living person:
    1. Anthropometric.
    2. Radiological.
    3. Magnetic resonance imaging.
    4. Ultrasound procedure.
    5. Preparation.
5. Planes used to determine the position of inner organs in a human body:
    1. Medial plane.
    2. Sagittal plane.
    3. Vertical plane.
    4. Horizontal plane.
    5. Frontal plane.
6. Which term is used to explain the structure closer to the median plane?
    1. Medial.
    2. Sagittal.
    3. Vertical.
    4. Horizontal.
    5. Frontal.

7. Which number indicates the sagittal plane in the figure? 8. Which number indicates the horizontal plane in the figure? 9. Which number indicates the frontal plane in the figure?	

10. Which number indicates the sagittal axis in this figure? 11. Which number indicates the frontal axis in the figure? 12. Which number indicates the vertical axis in the figure?	

13. Denote the main axes around which a human body moves:
    1. Vertical axis.
    2. Sagittal axis.
    3. Lateral axis.
    4. Medial axis.
    5. Frontal axis.
14. A human body includes the following parts:
    1. Head.
    2. Trunk.
    3. Upper limb.
    4. Lower limb.
    5. Abdomen.
15. An upper limb includes the following parts:
    1. Arm.
    2. Forearm.
    3. Hand.
    4. Wrist.
    5. Palm.
16. Bones of skeleton carry out following functions:
    1. Support.
    2. Movements.
    3. Protection.
    4. Exchange of mineral substances.
    5. Hematopoesis.
17. A human skeleton includes the following parts:
    1. Skull.
    2. Skeleton of the neck.
    3. Skeleton of the trunk.
    4. Skeleton of the upper limb
    5. Skeleton of the lower limb.
18. An appendicular skeleton of the human body includes the following formations:
    1. Skull.
    2. Spine (vertebral column).
    3. Thorax.
    4. Skeleton of the upper limb.
    5. Skeleton of the lower limb.
19. Which term is used to explain the structure located closer to the head:
    1. Anterior.
    2. Median.
    3. Cranial.
    4. External.
    5. Caudal.

20. An axial skeleton includes the following formations:
    1. Skull.
    2. Spine (vertebral column).
    3. Thorax.
    4. Skeleton of the upper limb
    5. Skeleton of the lower limb.
21. Periosteum carries out the following functions:
    1. Support.
    2. Protection.
    3. Hematopoesis.
    4. Trophic.
    5. Regenerative.
22. Features of the structure and the function of the long (tubular) bones:
    1. Medullary cavity is inside of the bone.
    2. They participate in supporting, protective and movement functions.
    3. Thickened ends are called epiphyses.
    4. They mainly consist of a spongy substance.
    5. Diaphysis and epiphysis are divided by the bone called metaphysis.

23. Which letter indicates the flat bone in the figure? 24. Which letter indicates the pneumatized bone in the figure? 25. Which letter indicates the spongy bone in the figure?	

Memorize the following eponyms

Leeuwenhoek or Haversian canal (A. van Leeuwenhoeck seu C. Havers) – osteon canal, *canalis osteoni,* - the canal in the center of the osteon formed by concentrically located lamella, contains blood vessels, nerves, connective tissue.

Volkmann's canal (A.W. Volkmann) – tubules in the compact substance of tubular bones, communicating with osteon canals, containing blood vessels, nerves, connective tissue.

Assignment for students to assess the acquired knowledge of the class topic

1. Show the anatomical position.
2. Show the planes accepted in anatomy using improvised means (notebook, piece of paper, etc).

3. Show the axis are accepted in anatomy using improvised means (pointer, pencil, etc.).
4. Explain the meaning of all the terms in Paragraph 5of the table block.
5. Show and name the parts of a human body. Show and name the parts of the trunk.
6. Find, show and name the axial and appendicular skeleton and their parts.
7. Find all types of bones in the set of bones.
8. Show and name the parts of the tubular bone.

References:

Main:	Additional:
1. P. 3-8, 39-42, 67-75.	5. P. 3-4.
2. C. 10-21.	6. P. 3-5.
4. P. 6-9.	7. P. 3.

Topic 2 Skeleton of the trunk: vertebrae, ribs and sternum

Aim of the class: to study the structure of vertebrae (to understand the structural features of the cervical, thoracic, lumbar vertebrae, sacrum and coccyx), ribs and sternum.

Motivational characteristics of the topic

The vertebral column is the axis of the skeleton. It supports all parts of the body and internal. The thoracic cage protects the internal organs. The knowledge of features of the vertebral column, ribs, sternum is necessary to study t surgery, traumatology, orthopedics, neurology, etc.

Main issues of the topic

1. Skeleton of the trunk: vertebral column and thoracic cage.
2. Parts of the vertebral column.
3. General plan of the structure of vertebrae: body, arch, foramen, processes.
4. Vertebrae have common signs and features in each part of the vertebral column.
5. General properties of ribs.
6. Distinctive features of the right and left ribs.
7. Features of the 1^{st}, 11^{th} and 12^{th} ribs.
8. Structure of the sternum.

Information section and recommendations on unsupervised activites

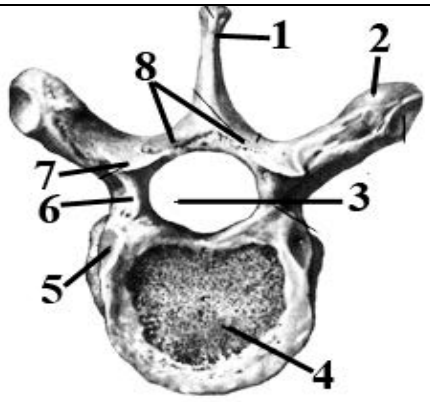
1. Determine the place of location of the vertebral column in the human skeleton and position it correctly in relation to yourself. Find the parts of the vertebral column (cervical, thoracic, lumbar, sacral, coccygeal).

2. You should begin the study of features of the structure of all vertebrae with determining the location of the vertebrae in the skeleton and its location in relation to yourself.
3. The general properties of vertebrae are easier to study on the thoracic vertebrae. Find the anatomical structures on vertebrae (body, arch, pedicles, vertebral foramen), determine on the arch: spinous process, transverse processes, superior and inferior articular processes.
4. Define the features of typical cervical vertebrae on the third-sixth vertebrae. Find the typical features of the structure: foramen transversarium, anterior tubercle, carotid tubercle, posterior tubercle, spinous process.
5. When studying the first and second cervical vertebrae, connect them and find the following formations: facet for dens and anterior tubercleon on the anterior arch; groove for vertebral artery and posterior tubercle on the posterior arch; superior and inferior articular surfaces on the lateral masses of atlas; dens, apex, anterior articular facet and posterior articular facet on the axis.
6. When studying the thoracic vertebrae, find the typical features of the structure: superior costal facet and inferior costal facet, transverse costal facet.
7. Find the accessory, costal and mammillary processes on the lumbar vertebrae.
8. When studying the sacral vertebrae, find the following formations: base, apex, pelvic surface, dorsal surface, lateral part, sacral canal on the sacrum; superior articular process, promontory on the base; auricular surface, sacral tuberosity on the lateral part; posterior sacral foramina, median sacral crest, intermediate sacral crests, lateral sacral crests, sacral hiatus on the dorsal surface; transverse ridges, anterior sacral foramina on the pelvic surface.
9. Find the coccygeal horns on the coccyx.
10. Determine the location of the ribs in the skeleton and distinguish true, false and floating ribs, the right ribs from the left ribs.
11. Define the features of the ribs by the example of the 2^{d} –$10t^{h}$ ribs. Find the following formations of the typical ribs: bony part, costal cartilage, on the head of the rib: articular facet, crest of the head, on the neck of the rib: crest, on the body: tubercle, groove and the angle of the rib.
12. Find on the first rib: scalene tubercle, groove for the subclavian artery, groove for the subclavian vein.
13. Determine the place of the location of the sternum in the skeleton and anatomical position in relation to yourself and find the following formations: manubrium, clavicular notches, jugular notch, body of sternum, sternal angle and the xiphoid process.
14. Write down the Latin terms in the student's vocabulary list and memorize them.

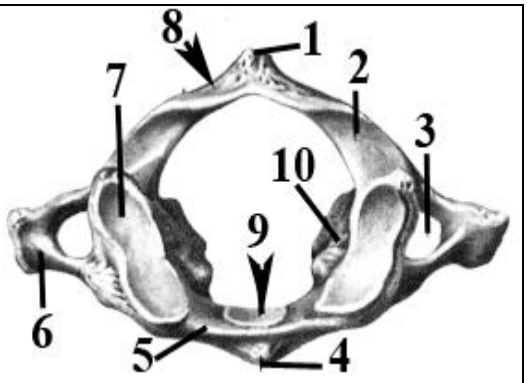
Visuals: the skeleton, a set of vertebrae, a set of paired ribs, sternum, X-rays.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

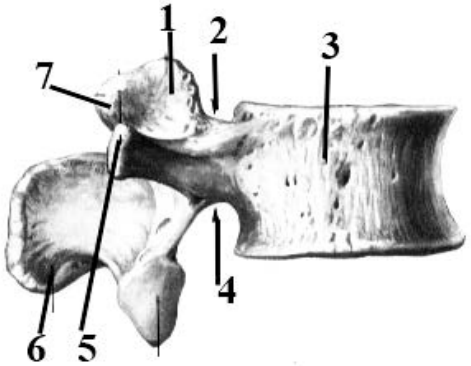
1. "Typical" vertebrae from cervical to lumbar have:
   1. Arch.
   2. Articular processes.
   3. Spinous process.
   4. Transverse processes.
   5. Coronoid process.
2. Vertebral foramen is bordered on:
   1. Vertebral body.
   2. Pedicles.
   3. Vertebral arch.
   4. Transverse process.
   5. Spinous process.
3. Which of the following statement(s) are/is correct about the cervical vertebra?
   1. The body of the vertebra is small.
   2. There are complete articular facets for articulation with ribs on the body.
   3. There is a foramen transversarium on the cervical vertebra.
   4. The transverse process has a mastoid process.
   5. The spinous process is bifurcated at the end.

4. Which number indicates the arch of the vertebra in the figure? 5. Which number indicates the transverse process in the figure? 6. Which number indicates the pedicle of the vertebral arch in the figure?	

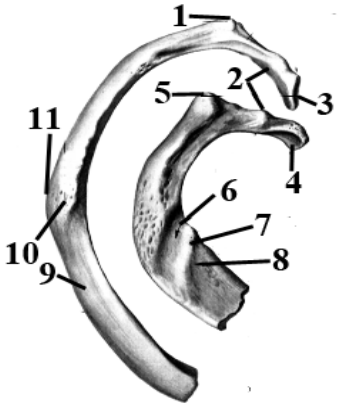
7. Vertebra prominens is:
   1. The 1st lumbar vertebra.
   2. The 1st thoracic vertebra.
   3. The 2nd cervical vertebra.
   4. The 6th cervical vertebra.
   5. The 7th cervical vertebra.
8. Which thoracic vertebrae have full costal facets on the body?
   1. II.
   2. X.
   3. I, XI, XII.
   4. X, XI, XII.
   5. I, X, XI.

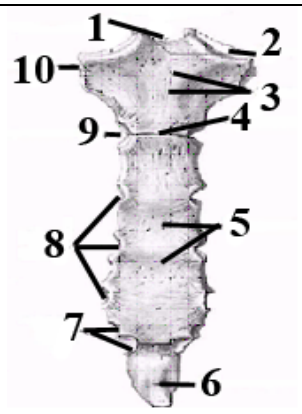
9. Which number indicates the foramen transversarium in the figure? 10. Which number indicates the superior articular surface in the figure? 11. Which number indicates the facet for dens in the figure??	

12. Which vertebra has the carotid tubercle?
    1. The 6th cervical vertebra.
    2. The 1st cervical vertebra.
    3. The 5th lumbar vertebra.
    4. The 7th cervical vertebra.
    5. The 1st thoracic vertebra.
13. Which vertebrae have mastoid and accessory processes?
    1. Cervical vertebrae.
    2. Sacral vertebrae.
    3. Lumbar vertebrae.
    4. Thoracic vertebrae.
    5. Coccygeal vertebrae.

14. Which number indicates the costal process in the figure? 15. Which number indicates the mammillary process in the figure? 16. Which number indicates the inferior vertebral notch in the figure?	

17. Each rib has:
    1. Body.
    2. Head.
    3. Neck.
    4. Anterior and posterior ends.
    5. Arch.
18. Sternal angle is the connecting place of:
    1. Manubrium of the sternum and clavicle.
    2. Manubrium of the sternum and body of the sternum.
    3. Manubrium of the sternum and the xiphoid process.
    4. Body of the sternum and the xiphoid process.
    5. Body of the sternum and body of the rib.

19. Which number indicates the neck of the rib in the figure? 20. Which number indicates the tubercle of the rib in the figure? 21. Which number indicates the angle of the rib in the figure? 22. Which number indicates the groove for the subclavian artery in the figure?	

23. Which number indicates the jugular notch of the sternum in the figure? 24. Which number indicates the clavicular notch in the figure? 25. Which number indicates the xiphoid process of the sternum in the figure?	

Situational tasks

1. A first-year student of a medical university saw a victim of a car accident lying on his/her back. The blood was running from the wound with a thin pulsating stream from his/her lower jaw. The future doctor put his/her finger on the neck and pressed the carotid artery to the carotid tubercle.

Where is the carotid tubercle located?

2. A 9-year old boy landed unsuccessfully on back. His friends brought him home. He complained of the pain in the sacral region. His parents saw bruising in the sacral region. The boy felt a severe pain in the sacral region. His parents took the boy to the trauma center. The light transverse lines were located at the same distance from each other on an X-ray.

Is it necessary to consider these strips as signs of a sacral fracture? Are they visible on the X-ray photogtaph of the sacral region of a healthy child?

3. A 20-year-old gymnast complained of a persistent pain in the thoracic part of the vertebral column. The pain appeared after landing. The patient received an X-ray of the thorax of the frontal and lateral projections. It is seen that the body of the 5th thoracic vertebra is much lower than the neighboring vertebrae.

Is the vertebral body height significantly lower than normal in the neighboring ones? Did it develop as a result of the unsuccessful jump? Which kind of pathology is indicated by such an X-ray?

Memorize the following eponyms

Chassaignac tubercle (Ch.M.E. Chassaignac), a carotid tubercle, *tuberculum caroticum* – is the strongly developed anterior tubercle of the transverse process of the VI cervical vertebra, to which the common carotid artery can be pressed to temporarily stop bleeding.

Lisfranc tubercle (nodule) (J. Lisfranc), a scalene tubercle, *tuberculum m. scaleni anterioris* is protrusion on the upper surface of the first rib; the place of attachment of the anterior scalene muscle. It is a guideline for pressing the subclavian artery to the rib during a temporary stop of bleeding.

Angle of Louis (P.C.A.Louis), a sternal angle, *angulus sterni* is the joint formed by the articulation of the manubrium and body of the sternum.

Assignment for students to assess the acquired knowledge of the class topic

1. Position correctly the vertebral column, name and show parts and the number of vertebrae in each of them.
2. Describe the basic distinctive formations of vertebrae using thoracic vertebrae.
3. Find the typical cervical vertebrae and describe the distinctive structural features of the cervical vertebrae.
4. Find the 1st cervical vertebra and describe the distinctive structural features of the atlas.
5. Find the 2^{nd}, 7^{th} cervical vertebrae and describe their distinctive structural features.
6. Find the thoracic vertebrae and describe their distinctive structural features.
7. Find the lumbar vertebrae and and describe their distinctive structural features.
8. Find the sacrum and show all anatomical sacral formations.
9. Find the coccygeal vertebrae and and describe their distinctive structural features.
10. Describe all anatomical structural elements of rib using 2^{nd} – 10^{th} ribs.
11. Find the first rib and describe its distinctive structural features.
12. Find the 11^{th} , 12^{th} ribs and explain their distinctive features.
13. Find the sternum and show its parts, notches and angle of the sternum.
15. Write down the Latin terms in the student's vocabulary list and memorize them.

References:

Main:

1. P. 75-83.
2. C. 21-47.
3. Рис. (Fig.) 19-21,153-157,183-184.
4. P. 10-20.

Additional:

5. P. 187-190,196-208.
7. P. 40-43.

Topic 3 The bones of upper limb (clavicle, scapula, humerus, ulna, radius, bones of the hand)

Aim of the class: to study the structure of the bones of the upper limb.

Motivational characteristics of the topic:

The knowledge about the structural features of the upper limbs' bones is essential in traumatology and orthopedics, neurology, surgery, radiology, etc.

Main issues of the topic

1. General structure of the upper limb.
2. The skeleton of shoulder girdle:
   a) clavicle;
   b) scapula.
3. The skeleton of the free part of upper limb:
   a) humerus;
   b) bones of forearm (radius, ulna);
   c) bones of t hand (carpal bones, metacarpals, phalanges).

Information section and recommendations on unsupervised activites

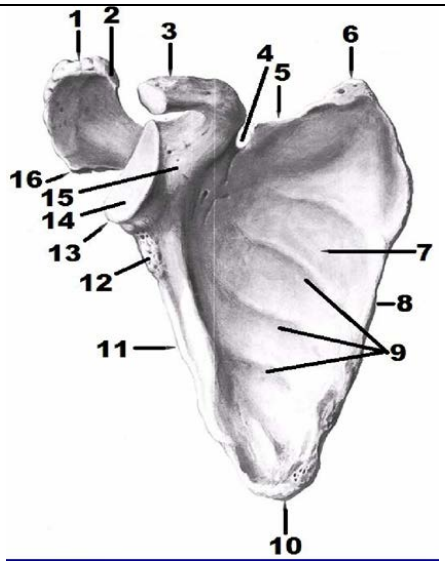
1. Find the bones of the upper limb on the skeleton and learn their division of the upper limb into the bones of the shoulder girdle (scapula and clavicle) and the free part of the upper limb (bone of arm, bones of forearm and bones of hand).
2. When studying the bones of the upper limb, determine to distinguish between the bones of the right and the left limbs, position correctly the bones in relation to yourself.
3. When studying the clavicle, find on it the following formations: sternal end (and sternal facet on it), body, acromial end (and acromial facet, conoid tubercle, trapezoid line on it).
4. When studying the scapula, find the following formations on it: medial, lateral and superior (and suprascapular notch) borders; superior, inferior and lateral angels, glenoid cavity and neck of scapula, supra- and infraflenoid tubercles, coracoid process on the lateral angel), costal surface (and the subscapular

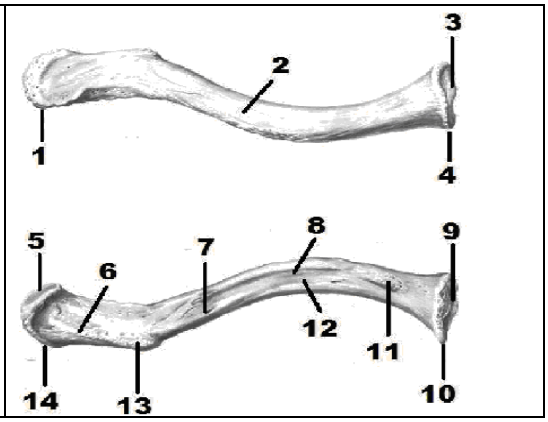
fossa on it), posterior surface (spine of scapula, acromion; supraspinos fossa and infraspinous fossa on it).
5. When studying the humerus, distinguish among the body, proximal and distal ends and find anatomical formations on them. Find on the proximal end: head of humerus, anatomical neck and surgical neck, greater and lesser tubercles, crest of greater tubercle and crest of greater tubercle, intertubercular sulcus; deltoid tuberosity, radial groove on the body; condyle of humerus, medial and lateral epicondyles, groove for ulnar nerve, trochlea, capitulum, olecranon fossa, coronoid fossa and radial fossa on the distal end:.
6. When studying the bones of the forearm (ulna and radius), learn how to position them correctly relative to each other, to distinguish among their body, proximal and distal ends. Find the following structures: olecranon and coronoid process, trochlear notch and radial notch, tuberosity of the ulna on the proximal end of the ulna; anterior, posterior and interosseous borders, anterior, posterior and medial surfaces on the body; head, articular circumference, ulnar styloid process on the distal end. Determine at the radius: head, articular facet and articular circumference, neck on the proximal end of the ulna; radial tuberosity, anterior, posterior and interosseous borders, anterior, posterior and lateral surfaces on the body; ulnar notch, radial styloid process, carpal articular surface on the distal end.
7. When studying the bones of the hand, learn to distinguish among the carpal bones, metacarpals and phalanges.
8. When studying the carpal bones, distinguish the proximal and distal and find the following bones (scaphoid, lunate, triquetrum, pisiform, trapezoid, capitate and hamate).
9. Learn to distinguish among the base, body and head on metacarpals.
10. Learn to distinguish between the proximal, middle and distal phalanges, and find the base, body and head on each of the phalanges.
11. Write down the Latin terms in the student's vocabulary list and memorize them.
Visuals: human skeleton, sternum, clavicle, scapula, a set of individual bones of the upper limb.

Test questions for self study and self-assessment or choice the right variant(s) of your answer:

1. Where is the glenoid cavity located?
   1. On the upper angle of the scapula.
   2. On the lateral angle of the scapula.
   3. On the acromion.
   4. On the lower angle of the scapula.
   5. On the body of the scapula.

2. Where are the coronoid tubercle and trapezoid line located?
   1. On the superior surface.
   2. On the medial surface.
   3. On the inferior surface.
   4. On the anterior surface.
   5. On the posterior surface.

3. Which number indicates the clavicular facet on the scapula in the figure? 4. Which number indicates the suprascapular notch in the figure? 5. Which number indicates the infraglenoid tubercle of the scapula in the figure?	

6. Which number indicates the acromial facet of the clavicle in the figure? 7. Which number indicates the sternal facet of the clavicle in the figure? 8. Which number indicates the co-noid tubercle of the clavicle in the figure?	

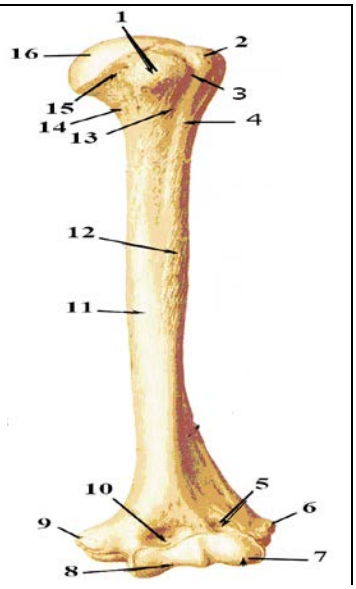
9. What is/are located at the proximal end of the humerus?
   1. Head.
   2. Condyle.
   3. Greater tubercle.
   4. Lesser tubercle.
   5. Intertubercle sulcus.
10. What is/are located at the distal end of the humerus?
   1. Condyle.
   2. Medial and lateral epicondyles.
   3. Coronoid fossa.
   4. Coronoid process.
   5. Fossa of the coronoid process.

11. Where is the radial groove located on the humerus?
    1. On the anterolateral surface.
    2. On the medial surface.
    3. On the anteromedial surface.
    4. On the anterior surface.
    5. On the posterior surface.

12. Which number indicates the intertubercular sulcus on the humerus in the figure?

13. Which number indicates the deltoid tuberosity of the humerus in the figure?

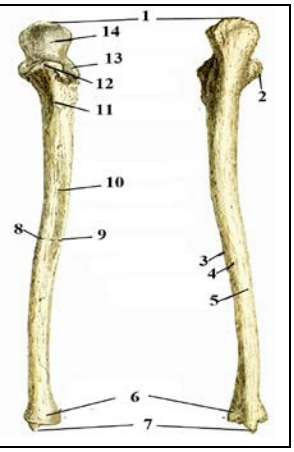
14. Which number indicates the coronoid fossa of the humerus in the figure?



15. Which number indicates the trochlear notch in the figure?

16. Which number indicates the interosseous border of the ulna in the figure?

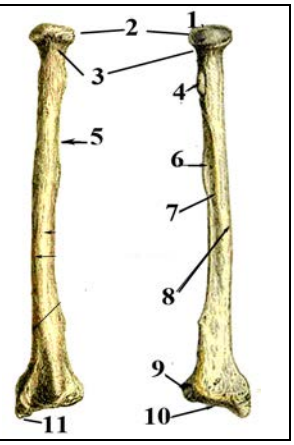
17. Which number indicates the ulnar styloid process in the figure?



18. Which number indicates the radial tuberosity in the figure?

19. Which number indicates the ulnar notch of the radius in the figure?

20. Which number indicates the radial styloid process in the figure?



21. Where is the the groove for the ulnar nerve located on the humerus?
1. Anteriorly the medial epicondyle.
2. On the medial surface of the humerus.
3. Above the olecranon fossa.
4. Behind the lateral epicondyle.
5. Behind the medial epicondyle.

22. What is located on the proximal epiphysis of the ulna?
1. Olecranon.
2. Coronoid process.
3. Radial notch.
4. Ulnar tuberosity.
5. Humeral process.

23. Which of the carpal bones are proximal?
1. Capitate.
2. Scaphoid.
3. Lunate.
4. Triquetrum.
5. Pisiform.

24. Which of the enumerated formations are accessible for palpation?
1. Acromion.
2. Spine of scapula.
3. Inferior angle of the scapula.
4. Subscapular fossa.
5. Sternoclavicular joint.

25. Which of the enumerated formations are accessible for palpation?
1. Epicondyles of the humerus.
2. Surgical neck of the humerus.
3. Olecranon.
4. Lateral malleolus and medial malleolus.
5. Radial and ulnar styloid processes.

Situational tasks

1. A 30-year-old patient fell from a ladder on his right arm, the pain appeared in the area of the right shoulder girdle. He turned to the trauma center for help. The examination revealed swelling in the right clavicle, a decrease in pulsation on the right radial artery. The X-ray determined comminuted fracture of the right clavicle with a significant displacement of the fragments.

Which of a clavicle fragment presses the subclavian artery located behind and below the clavicle?

2. After falling from a bicycle to the left upper limb, the injured turned to a trauma center. Clinical and radiological examination revealed a comminuted fracture of the left arm with displacement of the fragments and a symptom of a “wrist drop”

(inability to straighten a hand and fingers, indicating damage to the radial nerve). Most often, bone fragments damage the nerve in its adjacent to the bone.

Fragments of which part of the humerus are most likely damaged the radial nerve and why?

3. The patient has a severe bruise of the hand. To exclude pathology of the skeleton of the hand, an X-ray was taken, that revealed a bone formation in the distal row of the wrist bones.

Is it necessary to assume that this is the fragment of some kind of the carpal bone?

Assignment for students to assess the acquired knowledge of the class topic

1. Show and name the bones of the shoulder girdle.
2. Show and name the bones of the free part of the upper limb.
3. Show the clavicle, position it correctly in relation to yourself and show all anatomical formations on it.
4. Show the scapula, position it correctly in relation to yourself and show all anatomical formations on it.
5. Show the humerus, position it correctly in relation to yourself and show all anatomical formations on its body, proximal and distal ends.
6. Show the ulna, position it correctly in relation to yourself and show all anatomical formations on it.
7. Find the radius, position it correctly in relation to yourself and show all anatomical formations on it.
8. Find and name carpal bones, metacarpals, phalanges and all anatomical formations on the bones of the hand.

References:

Main:

1. P. 116-122.
2. C. 111-131.
3. Рис. (Fig.) 404.422.439.440.443.444.
4. P. 20-30.

Additional:

5. P. 6-31.

Topic 4 The bones of lower limb (hip bone, femur, patella, tibia, fibula, bones of foot)

Aim of the class: to study the structure of bones of the lower limb.

Motivational characteristics of the topic

The knowledge about the structural features of lower limbs' bones is essential in traumatology and orthopedics, neurology, surgery, radiology, urology and obstetrics, etc.

Main issues of the topic

1. The general view of the lower limb.
2. The skeleton of the pelvic girdle.
3. The skeleton of free part of the lower limb:
   a) femur,
   b) shin bones (tibia, fibula, patella),
   c) foot bones (tarsus, metatarsus, phalanges).

Information section and recommendations on unsupervised activites

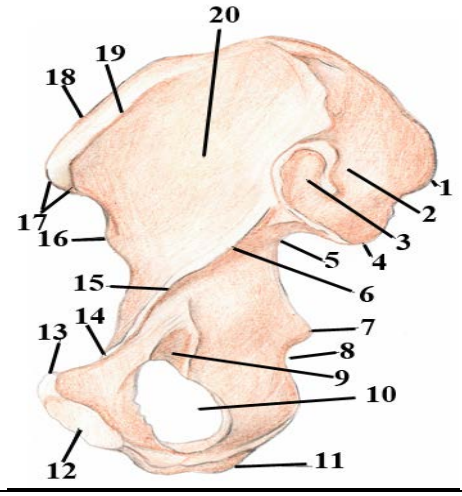
1. Define the lower limb on the skeleton and take into account the division of the lower limb into the pelvic girdle (hip bone) and the free part of the lower limb (thigh, leg, foot).
2. When studying the bones of lower limb, learn to distinguish between the bones of the right and the left limbs, position the bones in relation to yourself correctly.
3. Find the following formations of the hip bone: ilium, ischium, pubis, acetabulum. Consider that the acetabulum is formed by the parts of hip bone.
4. Find the following parts of the ilium: body of the ilium and ala of the ilium (wing of the ilium). Find the following formations on the wing of the ilium: iliac crest, anterior superior iliac spine, anterior inferior iliac spine, posterior superior iliac spine, posterior inferior iliac spine, outer and inner lips, intermediate line, gluteal and sacropelvic surfaces, and on the sacropelvic surface: iliac fossa, auricular surface, iliac tuberosity.
5. Find the following formations of the ischium: body and ramus, ischial spine, greater and lesser schiatic notches, ischial tuberosity.
6. Find the following formations of the pubis: body (iliopubic eminence on it); pubic crest, pubic tubercle, obturator crest, obturator groove on the superior pubic ramus; symphysial surface; the obturator foramen on the inferior pubic ramus.
7. Pay attention to the fact that the ilium, ischium, and pubis have connections of their bodies. On the outer surface this conection corresponds to the acetabulum, which has the acetabular notch, acetabular fossa and lunate surface.
8. When studying the femur, find the following structures: on the head (fovea for ligament of the head on it), neck, body (diaphysis of the femur). Determine greater trochanter, lesser trochanter, intertrochanteric line and crest on the superior epiphysis of the femur; linea aspera and its lateral and medial lips, pectineal line on the body; patellar surface, medial and lateral condyles (respectively medial and lateral epicondyles on them), popliteal surface, and intercondylar fossa on the distal epiphysis.
9. Determine the base and apex, articular and anterior surfaces on the patella.
10. When studing the shin bones, find the following farmations on the tibia: medial and lateral condyles, fibular articular facet, superior articular surface, anterior intercondylar area, posterior intercondylar area, intercondylar emi-

nence; tibial tuberosity, anterior, medial and interosseous borders, medial, posterior and lateral surfaces, soleal line on the body; medial malleolus, fibular notch, inferior articular surface on the distal epiphysis; head, articular facet, neck, body, lateral malleolus, lateral surface, medial surface, posterior surface, anterior border, interosseous border, posterior border, malleolar fossa, malleolar groove on the fibula.
11. When studying the bones of the foot, consider their division into 3 parts: tarsal bones, metatarsal and phalanges.
12. Determine the tarsal bones: talus, calcaneus navicular, cuboid, medial cuneiform, lateral cuneiform, intermediate cuneiform. Find the anatomical formations on the tarsal bones: body of talus, neck of talus, head of talus, trochlea of talus, sulcus tali; calcaneal tubercle, calcaneal sulcus, sustentaculum tali on the calcanes.
13. Define to distinguish among the base, the body, and the head of metatarsals.
14. Define to distinguish among the proximal, middle and distal phalanges, and find the base, the body and the head on each of the phalanges.
15. Write down the Latin terms in the student's vocabulary list and memorize them.

Visuals: a human skeleton, a pelvis, bones of the pelvic girdie, bones of the free part of the lower limb.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Which number indicates the auricular surface in the figure?
2. Which number indicates the arcuate line in the figure?
3. Which number indicates the ischiatl spine on the figure?



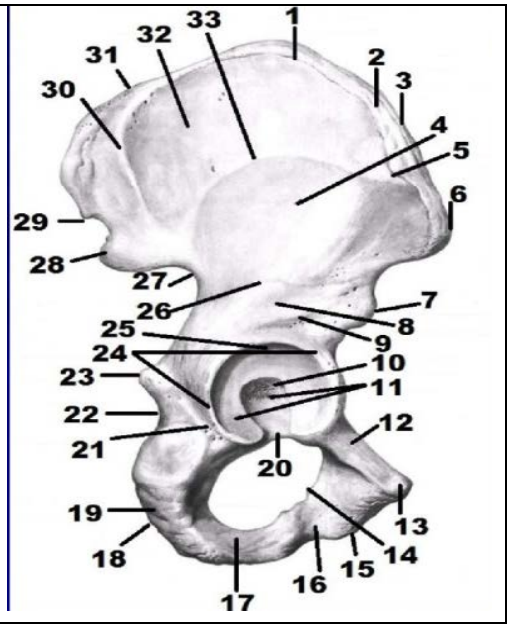
4. Indicate the anatomical structures of the hip bone:
   1. Acetabulum.
   2. Outer lip.
   3. Obturator groove.
   4. Greater schiatic notch.
   5. Piriform foramen.

5. Indicate the anatomical structures of the ilium.
   1. Anterior gluteal line.
   2. Obturator foramen.
   3. Auricular surface.
   4. Arcuate line.
   5. Acetabular notch.

6. Which number indicates the acetabular fossa in the figure?

7. Which number indicates the anterior superior iliac spine in the figure?

8. Which number indicates the ischial tuberosity in the figure?

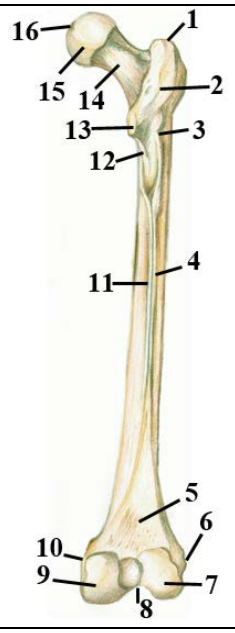


9. Where is the obturator groove located?
   1. Inferior pubic ramus.
   2. Ischial ramus.
   3. Ischial body.
   4. Wing of the ilium.
   5. Superior pubic ramus.
10. What is/are located on the proximal end (epiphysis) of the femur?
   1. Greater trochanter.
   2. Lesser trochanter.
   3. Intercondylar fossa.
   4. Intertrochanteric crest.
   5. Neck of the femur.
11. What is/are located on the distal epiphysis of the femur?
   1. Patellar surface.
   2. Linea aspera.
   3. Medial condyle.
   4. Lateral condyle.
   5. Popliteal surface.

12. Which number indicates the neck of the femur in the figure?

13. Which number indicates the greater trochanter in the figure?

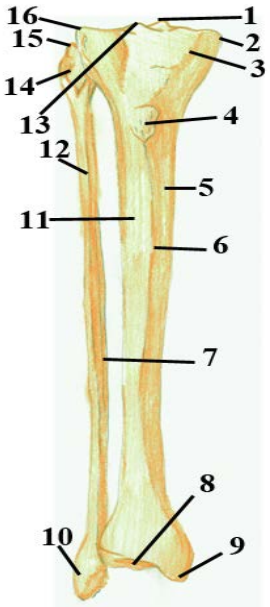
14. Which number indicates the medial epicondyle in the figure?



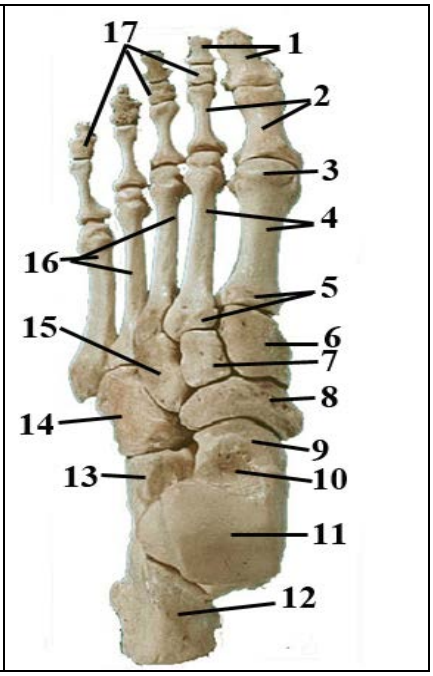
15. Which number indicates the tibial tuberosity in the figure?

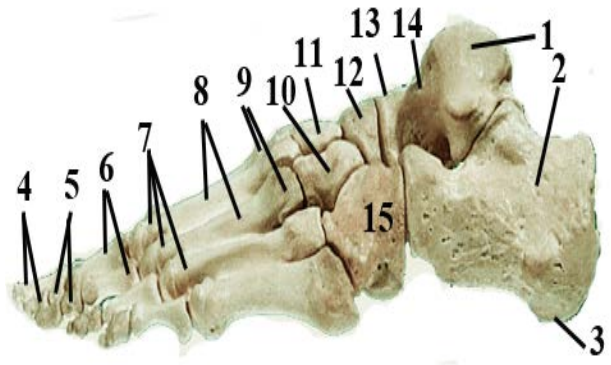
16. Which number indicates the medial malleolus in the figure?

17. Which number indicates the anterior border of the tibia in the figure?



18. Which of the following formation(s) is/are located on the tibia?
    1. Condylus medialis.
    2. Fossa intercondylaris.
    3. Facies articularis fibularis.
    4. Eminentia intercondylaris.
    5. Linea terminalis.
19. Which of the following formation(s) is/are located on the proximal epiphysis of the tibia?
    1. Intercondylar eminence.
    2. Anterior intercondylar area.
    3. Posterior intercondylar area.
    4. Fibular articular facet.
    5. Medial malleolus.

20. Which number indicates the cuboid in the figure? 21. Which number indicates the middle phalanx in the figure? 22. Which number indicates the navicular in the figure?	

23. Which number indicates the calcaneal tubercle in the figure? 24. Which number indicates the trochlea of talus in the figure? 25. Which number indicates the lateral cuneiform in the figure?	

Situational tasks

1. The injured in a traffic accident had a femoral fracture in the upper third. To restore the integrity of the bone, it was decided to perform intramedullary osteosynthesis (insert a direct metal rod into the medullary canal of the bone diaphysis).

Through which part of the femur is it advisable to introduce the metal rod for matching fragments in order to preserve the axis of diaphysis of the bone not to damage the articular surface?

2. A 15-year old teenager fell on his left side after a high jump during a PE lesson. He turned to the trauma center of the city hospital for help with complaints of a severe pain in the left ilium. When performing passive movements the pain intensified in the hip joint. The X-ray revealed visible bands of enlightenment passing through the acetabulum.

Are the data sufficient for the diagnosis of a "fracture of the left hip bone" and why?

3. A woman of 60 years of age fell from a height on her heels and felt pain in the left heel. She could not lean on and walk on it. The ambulance doctor revealed a swelling below the ankle joint, the pain during palpation of the calcaneal region, flattening of the longitudinal arch of the left foot in comparison with the right and lower height of the left foot, the increased pain with tension of the posterior muscles of the leg.

What is the reason for flattening the foot? Does the patient need specialized medical care and immobilization before transportation?

Memorize the following eponyms

Bryant's triangle (Th. Bryant) is a normal isosceles triangle, the sides of which are: 1) drawn through the greater trochanter of the axis of the thigh bent to 180 degrees; 2) the perpendicular to this axis from the anterior superior iliac spine; 3) the line between the anterior superior iliac spine and the superior point of the greater trochanter. With the displacement of the greater trochanter as a result of any pathology (congenital dislocation of the hip, traumatic dislocation, etc.), the isosceles of this triangle is disrupted.

Nelaton's Line (A. Nelaton) or **Roser-Nélaton line** (W. Rozer) is a straight line connecting the anterior superior iliac spine of the ilium, the upper point of the greater trochanter and ischial tuberosity. When the femoral head is deflected, it bends.

Assignment for students to assess the acquired knowledge of the class topic:

1. Show and name the bones of the pelvic girdle.
2. Show and name the bones of a free part of the lower limb.
3. Find the pelvic bone, position it correctly in relation to yourself, show the ilium, ischium, pubis and all anatomical formations on these bones.
4. Find the femur, position it correctly in relation to yourself, and show all anatomical formations on the diaphysis, proximal and distal ends.
5. Find the patella, position it correctly in relation to yourself, show all anatomical formations on it.
6. Find the tibia, position it correctly in relation to yourself, and show all anatomical formations on the diaphysis, proximal and distal ends of the bone.
7. Find the fibula, position it correctly in relation to yourself, and show all anatomical formations on it.
8. Find the bones of foot, position them correctly in relation to yourself, show all tarsal bones, metatarsals, phalanges and anatomical formations on these bones.

References:

Main:

1. P. 122-129.
2. C. 131-164.
3. Рис. (Fig.) 330-334,473-478,500-502,511-513.
4. P. 31-43.

Additional:

6. P. 6-39.

Topic 5 Cranium: neurocranium and viscerocranium. Bones of neurocranium; (frontal bone, parietal bone, occipital bone, sphenoidal bone, ethmoidal bone)

Aim of the class: learn to distinguish neurocranium and viscerocranium, calvaria and cranial base. Study the structure of cranial bones (frontal bone, parietal bone, occipital bone, sphenoidal bone, ethmoidal bone).

Motivational characteristics of the topic

The knowledge of the structural features of the cranial bones is necessary for the diagnosis of injuries, head diseases and surgical interventions for this pathology by neurosurgeons, traumatologists, otorhinolaryngologists, ophthalmologists.

Main issues of the topic

1. The general structure of the bones of the cranium.
2. Cranial bones:
    a) frontal bone;
    b) parietal bone;
    c) occipital bone;
    d) sphenoidal bone;
    e) ethmoidal bone.

Information section and recommendations on unsupervised activites

1. Determine the location of the bones of the cranium in the skeleton and its division into the neurocranium and viscerocranium, as well as on the calvaria and the cranial base.
2. When studying the frontal bone, determine its place in the skull, find its parts (squamous part, nasal part, orbital parts), then anatomical formations in it. Find the following formations: frontal tuber, superciliary arch, glabella, supra-orbital margin, supra-orbital notch on the squamous part of the external surface; temporal line, zygomatic process on the temporal surface; frontal crest, groove for superior sagittal sinus, foramen caecum on the internal surface; nasal spine, ethmoidal notch, frontal sinus on the nasal part; fossa for lacrimal gland, trochlear fovea on the orbital part of the orbital surface.
3. Learn to distinguish between the right and the left parietal bones, determine its place in the skull, find its borders (frontal, sagittal, occipital, squamosal), angles (frontal, occipital, mastoid, sphenoidal), parietal tuber, parietal foramen.
4. When studying the occipital bone, determine its place in the skull, find the foramen magnum and, parts of occipital bone (basilar, lateral, squamous). Find then anatomical formations: clivus, pharyngeal tubercle on the basilar part; occipital condyle, hypoglossal canal, jugular process, jugular notch on the lateral part; exter-

nal and internal occipital protuberances, external and internal occipital crests, highest nuchal line, superior nuchal line, inferior nuchal line, cruciform eminence, groove for superior sagittal sinus, groove for transverse sinus, groove for sigmoid sinus on the squamous part.

5. When studying the sphenoidal bone, determine its place in the skull. Find parts of the sphenoidal bone: body, greater wings, lesser wings, pterygoid processes; prechiasmatic sulcus, sella turcica, tuberculum sellae, dorsum sellae, hypophysial fossa, sphenoidal sinus, opening of sphenoidal sinus on the body; optic canal on the lesser wing; orbital surface, cerebral surface, temporal surface, infratemporal surface, maxillary surface, foramen ovale, foramen spinosum, foramen rotundum, infratemporal crest on the greater wing; superior orbital fissure between the wings; medial and lateral plates, pterygoid hamulus, pterygoid canal, pterygoid notch, pterygoid fossa on the pterygoid process.

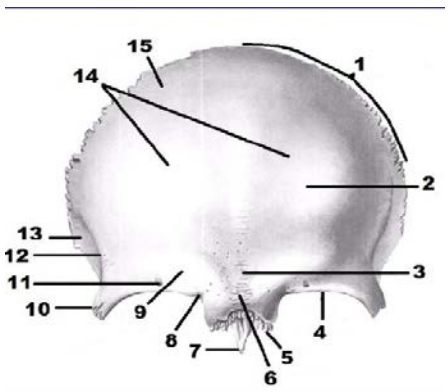
6. When studying the ethmoidal bone, determine its place in the skull, find its parts (perpendicular plate, cribriform plate, crista galli, ethmoidal labyrinth, ethmoidal cells, orbital plate, superior nasal concha, middle nasal concha).

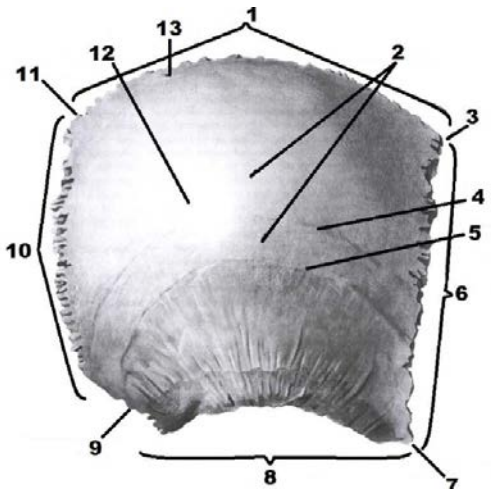
7. Write down the Latin terms in the student's vocabulary list and memorize them.

Visuals: a skull, a cranial base, a calvaria, a frontal bone, a parietal bone, an occipital bone, a sphenoidal bone, an ethmoidal bone.

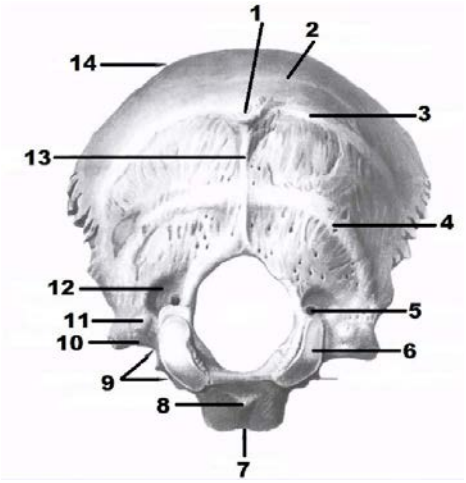
Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

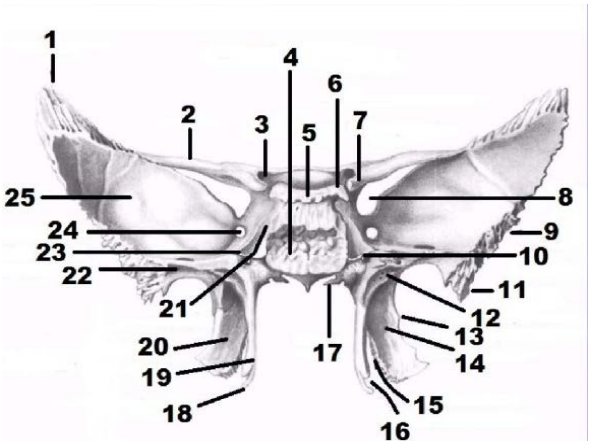
1. The correct characteristics of the frontal bone are:
   1. It consists of 4 parts.
   2. It has 2 tubercles.
   3. It has finger impression.
   4. It consists of 5 parts.
   5. It has 2 temporal lines.
2. What groove is located on the frontal bone?
   1. Groove for superior sagittal sinus
   2. Groove for transverse sinus
   3. Groove for superior petrosal sinus
   4. Groove for inferior petrosal sinus
   5. Groove for sigmoid sinus.
3. The parietal bone has the following angles:
   1. Frontal.
   2. Occipital.
   3. Sphenoidal.
   4. Mastoid.
   5. Petrosal.

4. Which number indicates the temporal line in the figure? 5. Which number indicates the supra-orbital margin in the figure? 6. Which number indicates the nasal spine in the figure?	

7. Which number indicates the sphenoidal angle in the figure? 8. Which number indicates the sagittal border in the figure? 9. Which number indicates the parietal foramen in the figure?	

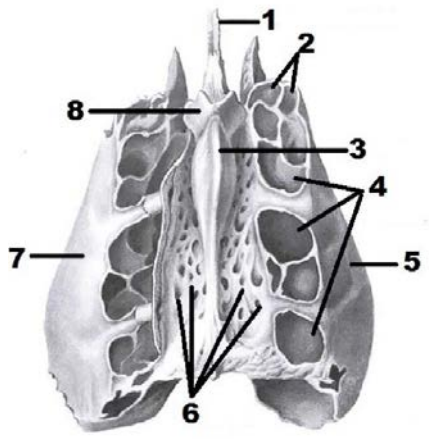
10. Which of the following formation(s) is/are located on the parietal bone?
    1. Anterior temporal line.
    2. Groove for superior sagittal sinus.
    3. Groove for sigmoid sinus.
    4. Arterial grooves.
    5. Parietal tuber.
11. Which of the following grooves are located on the internal surface of squamous part of the occipital bone?
    1. Sulcus sinus transversus.
    2. Sulcus sinus sagittalis superioris.
    3. Sulcus sinus sigmoidei.
    4. Sulcus sinus sagittalis inferior.
    5. Sulcus sinus petrosi inferioris.
12. The following structures are located in the sphenoid:
    1. Foramen rotundum.
    2. Foramen ovale.
    3. Foramen spinosum.
    4. Foramen lacerum.
    5. Mastoid foramen.

13. Which number indicates the superior nuchal line in the figure? 14. Which number indicates the condylar canal in the figure? 15. Which number indicates the pharyngeal tubercle in the figure?	

16. Which number indicates the optic canal in the figure? 17. Which number indicates the pterygoid notch in the figure? 18. Which number indicates the foramen rotundum in the figure?	

19. Paranasal sinuses are located in:
    1. Frontal bone.
    2. Parietal bone.
    3. Occipital bone.
    4. Sphenoidal bone.
    5. Ethmoidal bone.
20. The canal(s) for blood vessels and nerves is/are located in the following bones:
    1. Occipital bone.
    2. Sphenoidal bone.
    3. Parietal bone.
    4. Frontal bone.
    5. Ethmoidal bone.
21. The following surfaces are located on the greater wing of the sphenoidal bone:
    1. Orbital surface.
    2. Cerebral surface.
    3. Temporal surface.
    4. Infratemporal surface.
    5. Maxillary surface.

22. The ethmoidal bone has:
1. Cribriform plate.
2. Crista galli.
3. Foramen ovale.
4. Orbital plate.
5. Perpendicular plate.

23. Which number indicates the perpendicular plate in the figure? 24. Which number indicates the crista galli in the figure? 25. Which number indicates the ethmoidal labyrinth in the figure?	

Situational tasks

1. An injured person in a car accident had a damage in soft tissues of the head in the parietal tubercle. An external examination showed no bone damage. Nevertheless, the patient was assigned X-ray images of the skull in two projections.

Which structural feature of the parietal bone require to prescribe the examination?

2. Going out hatless into the street in a very severe frost when inhaling, a foreign student felt a sharp pain in the area of the glabella.

Where did the cold air get at the inhalation?

3. A 22-year-old man has chronic rhinitis (inflammation of the nasal mucosa). It was complicated by purulent sphenoiditis (inflammation of the sphenoid sinus). There is a threat of purulent fusion of the sinus walls.

The destruction of which wall of the sphenoid sinus is most dangerous and why?

Memorize the following eponyms

Blumenbach clivus (J.F. Blumenbach), clivus, *clivus*, a gutter located from the back of the sella turcica of the sphenoidal bone on the inner (brain) surface of the basilar part of the occipital bone to the foramen magnum. The medulla oblongata and the pons, the basilar artery lie on it.

Vidian canal (G.G. Vidianus) – pterygoid canal, *canalis pterygoideus* is the canal of the sphenoid.

Assignment for students to assess the acquired knowledge of the class topic:

1. Show the bones of the neurocranium.
2. Find the parietal bone, position it correctly in relation to yourself, and show all anatomical formations of this bone.
3. Find the frontal bone, position it correctly in relation to yourself, and show all anatomical formations of this bone.
4. Find the occipital bone, position it correctly in relation to yourself, and show all anatomical formations of this bone.
5. Find the ethmoidal bone, position it correctly in relation to yourself, and show all anatomical formations of this bone.
6. Find the sphenoidal bone, position it correctly in relation to yourself, and show all anatomical formations of this bone.

References:

Main:

1. P. 83-89.
2. C. 47-62, 69-72.
3. Рис. (Fig.) 4-14.
4. P. 44-50, 56-62.

Additional:

7. P. 3-26, 43-44.

Topic 6 The temporal bone. Canals of temporal bone. The bones of the viscerocranium: maxilla and mandible, palatine bone, lacrimal bone, zygomatic bone, nasal bone, hyoid bone, inferior nasal concha, vomer

Aim of the class: to study the structure of the temporal bone and its canals. To study the structure of viscerocranium: maxilla and mandible, palatine bone, lacrimal bone, zygomatic bone, nasal bone, hyoid bone, inferior nasal concha, vomer.

Motivational characteristics of the topic

The knowledge of the structural features of the temporal bone, its canals as well as the bones of viscerocranium is necessary for otorhinolaryngologists, neurosurgeons, traumatologists, ophthalmologists, radiologists.

Main issues of the topic

1. Temporal bone:
   a) squamosus part;
   b) tympanic part;
   c) petrous part.

2. Canals of the temporal bone and their contents:
   a) carotid canal;
   b) facial canal;
   c) musculotubal canal;
   d) caroticotympanic canaliculi;
   e) canaliculus for chorda tympani;
   f) tympanic canaliculus;
   g) mastoid canaliculus.
3. Maxilla.
4. Mandible.
5. Viscerocranium:
   a) palatine bone;
   b) lacrimal bone;
   c) zygomatic bone;
   d) nasal bone;
   e) hyoid bone;
   f) inferior nasal concha;
   g) vomer.

Information section and recommendations on unsupervised activites

1. Determine the location of the temporal bone in the skull and learn to distinguish the right bone from the left one.
2. When studying the temporal bone, find its parts (squamosus part, tympanic part, petrous part); external acoustic opening and external acoustic meatus on the external surface; petrotympanic, petrosquamous, tympanosquamous, tympanomastoid fissures.
3. When studying the squamosus part of the temporal bone find: zygomatic process, mandibular fossa, articular surface, articular tubercle, arterial grooves.
4. When studying the petrous part, determine anterior, posterior and inferior surfaces of the petrous part, anterior, superior and posterior borders of the petrous part, its apex and base, mastoid process.
5. Find the following formations: tegmen tympani, arcuate eminence, hiatus for greater petrosal nerve, hiatus for lesser petrosal nerve, trigeminal impression on the anterior surface of the petrous part; internal acoustic opening, internal acoustic meatus on the posterior surface; jugular fossa, petrosal fossula, styloid process, stylomastoid foramen on the inferior surface, grooves for superior and inferior petrosal sinuses on the edges.
6. Find in the area of the mastoid process: groove for sigmoid sinus and occipital groove, mastoid notch, mastoid foramen.
7. Studying the structure of the canals of the temporal bone is very important and we recommend to study them based on below descriptions:

The carotid canal (is a passage for the internal carotid artery). It begins on the inferior surface of the pyramid at the external opening of the carotid canal. It is at first directed upwards, then bends nearly at the right angle and goes medially to the front. The canal ends at the internal opening of the carotid canal at the apex of the pyramid.

There are two or three **caroticotympanic canaliculi** in the carotid canal They go into the tympanic cavity.

The musculotubal canal has a common wall with the carotid canal. It begins at the apex of the pyramid, goes laterally to the back and enters in the tympanic cavity. A horizontal septum divides this canal into two parts. One of them is the canal for tensor tympani, and below it is the canal for the auditory tube.

The facial canal (contains a section of the facial nerve) begins in the external acoustic meatus. First it is directed perpendicularly to the long axis of the pyramid. At the level of the hiatus for the greater petrosal nerve it bends at the right angle and continues laterally to the back. Then, the canal turns vertically down, rounds the tympanic cavity and ends as the stylomastoid foramen.

The canaliculus for chorda tympani begins at the wall of the facial canal, near its end, and opens into the tympanic cavity. This canal is a passage for the chorda tympani.

The tympanic canaliculus begins in the petrosal fossula. It is directed upwards, it penetrates the lower wall of the tympanic cavity. Then, the canal continues through the medial wall and ends in the region of the hiatus for the lesser petrosal nerve. This canal is a passage for the tympanic nerve.

The mastoid canaliculus begins in the jugular fossa and ends in the tympanomastoid fissure. The auricular branch of the vagus nerve passes through this canal.

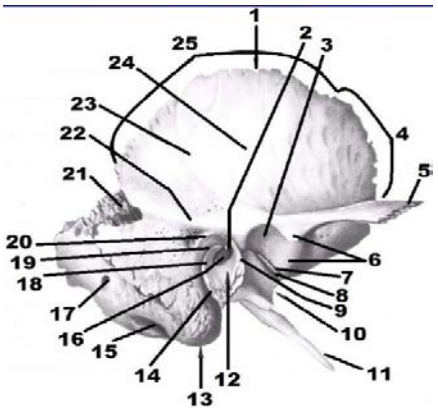
8. Find all bones which form the viscerocranium.
9. When studying the maxilla, determine its place in the skull, learn to distinguish the right bone from the left and find anatomical formations in it (body, frontal, zygomatic, palatine, alveolar processes), then orbital, nasal, anterior, infratemporal surfaces of the body, infraorbital groove, infraorbital canal, infraorbital foramen and infraorbital margin, canine fossa, nasal notch, anterior nasal spine, maxillary tuberosity, lacrimal groove, maxillary sinus, maxillary hiatus, nasal crest, alveolar arch, dental alveoli, alveolar yokes.
10. When studying the mandible, determine its place in the skull, find its parts (body and ramus) and find anatomical formations in it (base, alveolar part, mental protuberance, mental tubercle, mental foramen, mental spine, oblique line, digastric fossa, mylohyoid line, mylohyoid groove, alveolar arch, dental alveoli, alveolar yokes, angle of mandible, mandibular foramen, mandibular

canal, coronoid process, condylar process, head of mandible, neck of mandible, pterygoid tuberosity, masseteric tuberosity).
11. When studying the palatine bone, determine its place in the skull, find the perpendicular plate and horizontal plate, orbital, sphenoidal and pyramidal processes, greater palatine groove, sphenopalatine notch, nasal crest, posterior nasal spine.
12. When studying the zygomatic, nasal, lacrimal, hyoid bones, inferior nasal concha, vomer, determine their place in the skull, find anatomical formations in them (lateral, temporal and orbital surfaces, temporal and frontal processes of zygomatic bone; body of hyoid bone, lesser and greater horns).
8. Write down the Latin terms in the student's vocabulary list and memorize them.

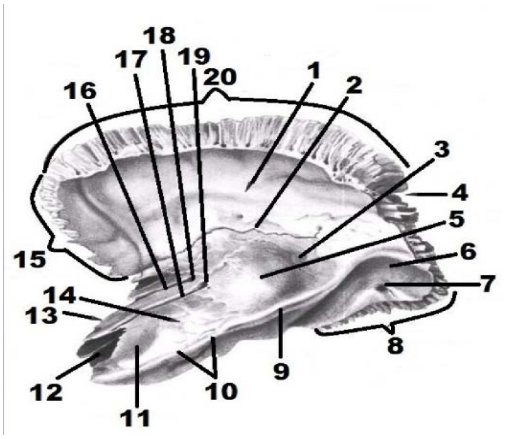
Visuals: a cranial base, a temporal bone, a maxilla, a mandible, zygomatic and hyoid bones, museum preparations.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. In which part of the temporal bone are the tympanic cavity and the bony labyrinth located?
   1. Squamosus part.
   2. Tympanic part.
   3. Petrous part.
   4. Tympanic, squamosus parts.
   5. Mastoid part.

2. Which number indicates the mandibular fossa in the figure? 3. Which number indicates the styloid process in the figure? 4. Which number indicates the mastoid process in the figure?	

5. What is/are located in the temporal bone?
   1. Mastoid foramen.
   2. External acoustic opening.
   3. External opening of carotid canal.
   4. Jugular foramen.
   5. Stylomastoid foramen.

6. Which number indicates the internal opening of the carotid canal in the figure? 7. Which number indicates the groove for the superior petrosal sinus in this figure? 8. Which number indicates the tegmen tympani in the figure?	

9. What is/are located on the temporal bone?
   1. Carotid groove.
   2. Groove for sigmoid sinus.
   3. Groove for superior petrosal nerve.
   4. Groove for greater petrosal nerve.
   5. Groove for lesser petrosal nerve.

10. What canals are located in the temporal bone?
   1. Canalis facialis.
   2. Canalis carotucus.
   3. Canalis musculotubarius.
   4. Canalis pterygoideus.
   5. Canalis opticus.

11. What is/are located on the anterior surface of the petrous part of the temporal bone?
   1. Arcuate eminence.
   2. Tegmen tympani.
   3. Trigeminal impression.
   4. Hiatus for greater petrosal nerve.
   5. Subarcuate fossa.

12. What is/are located on the inferior pyramid surface of the temporal bone?
   1. Jugular fossa.
   2. Mastoid foramen.
   3. External opening of the carotid canal.
   4. Mastoid notch.
   5. Petrosal fossula.

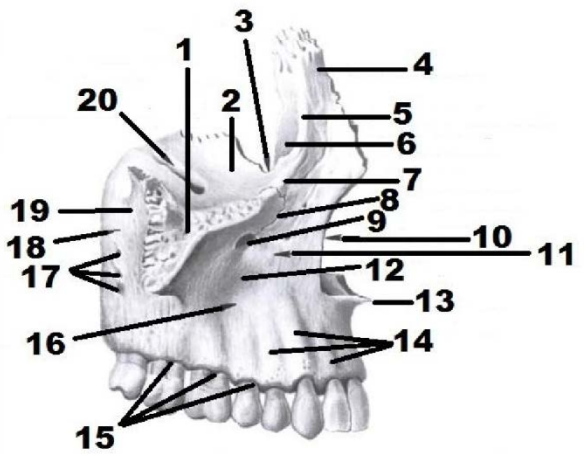
13. What is/are located in the temporal bone?
   1. Petrosquamous fissure.
   2. Pterygo-maxillary fissure.
   3. Tympanomastoid fissure.
   4. Tympanosquamous fissure.
   5. Petrotympanic fissure.

14. What surfaces are distinguished on the body of the maxilla?
    1. Orbital surface.
    2. Nasal surface.
    3. Palatine surface.
    4. Anterior surface.
    5. Infratemporal surface.
15. What processes are there in the maxilla?
    1. Temporal process.
    2. Frontal process.
    3. Zygomatic process.
    4. Alveolar process.
    5. Palatine process.

16. Which number indicates the infraorbital groove in the figure?

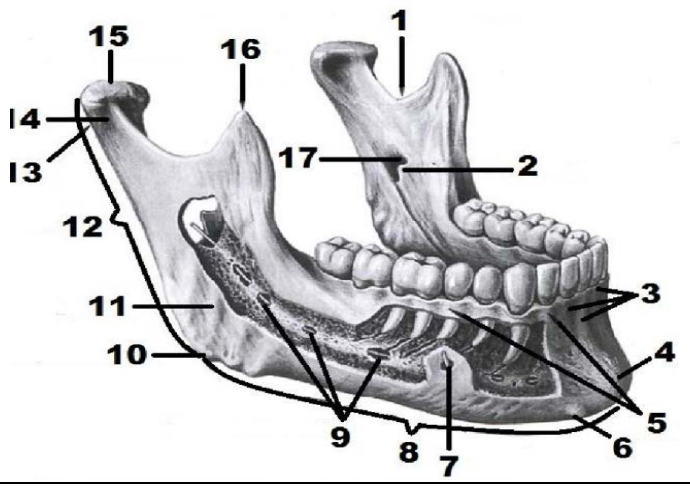
17. Which number indicates the nasal notch in the figure?

18. Which number indicates the zygomatic process in the figure?



19. A hypoglossal canal is located in:
    1. Mandibula.
    2. Hyoid bone.
    3. Palatine bone.
    4. Temporal bone.
    5. Occipital bone.
20. Which of the following correctly describe(s) the maxilla?
    1. It has the body (corpus maxillae).
    2. It has 4 processes.
    3. It has the infra-orbital foramen.
    4. It has the orbital surface.
    5. It has the greater palatine groove.
21. What is/are the following formation(s) of the mandible?
    1. Foramen mentale.
    2. Fossa digastrica.
    3. Fovea sublingualis.
    4. Linea mylohyoidea.
    5. Fovea pterygoidea.

22. Identify the most medial structure on the palatine bone:
1. Horizontal plate.
2. Nasal crest.
3. Sphenoidal process.
4. Pyramidal process.
5. Perpendicular plate.

23. Which number indicates the coronoid process in the figure? 24. Which number indicates the mandibular canal in the figure? 25. Which number indicates the angle of mandible in the figure?	

Situational tasks

1. Due to the chronic inflammation of the tympanic cavity (middle ear), the patient had the symptoms indicating a damage to the facial nerve passing through the facial canal.

Through which connections (openings) could the inflammation from the tympanic cavity to the facial canal pass?

2. The patient had symptoms of a facial nerve damage after an injury of the temporal region. An X-ray of the skull revealed a line of fracture of the temporal pyramid. It is perpendicular to the axis of the pyramid, outward from the internal acoustic opening.

Explain the reason why the localisation of the fracture is the cause of the identified symptoms of the facial nerve damage in its canal?

3. A teenager has been injured in a street fight. He was taken to a trauma center. He complained of the pain in the lower jaw on the left. There is a swelling in this area. On the control X-ray a line of enlightenment is seen, passing arched from the level of the 3rd tooth along the base of the jaw to the middle of its branch.

Explain, based on your knowledge of the lower jaw anatomy, why the doctor of the trauma center did not consider this line of enlightenment as a reliable sign of a fracture of the lower jaw.

Memorize the following eponyms

Glaserian fissure (J.H.Glaser), petrotympanic fissure, *fissura petrotympanica is* the fissure of the temporal bone.

Shipo triangle (A. Chipault) is a triangular-shaped area on the lateral surface of the mastoid process of the temporal bone, it is the place of an antrotomy for the opening of a mastoid antrum with purulent inflammation. The boundaries of the triangle are the continuation of the lower temporal line of the parietal bone to the temporal bone on top, connecting the apex of the mastoid process with the supra-passageway in front, the line of attachment of sternocleidomastoid muscle behind.

Eustachian tube (B. Eustachi) - auditory tube, *tuba auditiva* is connecting the tympanic cavity with the nasopharynx. Its bony part is formed by the canal for auditory tube of the temporal bone.

Antrum of Highmore (N. Highmore), *sinus maxillaris*, maxillary sinus.

Assignment for students to assess the acquired knowledge of the class topic:

1. Find the temporal bone, position it correctly in relation to yourself, and show the squamosus and tympanic parts and all anatomical formations of this bone.
2. Find the temporal bone, position it correctly in relation to yourself, and show the petrous part and all anatomical formations located on the anterior, posterior, inferior surfaces of the temporal bone.
3. Find the temporal bone, position it correctly in relation to yourself, show the inlet (outlet) canal openings and canaliculi of the temporal bone.
4. Show the bones of the viscerocranium.
5. Find the maxilla, show the body, processes and all anatomical formations of this bone.
6. Find the mandible, show the body, ramus of mandibule and all anatomical formations of this bone.
7. Find the zygomatic bone and show all anatomical formations of this bone.
8. Find the palatine bone and show all the anatomical formations of this bone.
9. Find the nasal bone, inferior nasal concha, vomer and all anatomical formations of these bones.
10. Find the hyoid bone and show all anatomical formations of this bone.

References:

Main:

1. P. 89-99.
2. C. 62-69, 72-84.
3. Рис. (fig.) 4-17.
4. P. 51-55, 63-72.

Additional:

7. P. 5-39.

Topic 7 Topography of the skull: calvaria and cranial base, orbital cavity, nasal cavity. Temporal, infratemporal, pterygopalatine fossae. Neonatal skull. Concept of craniometry. X-ray anatomy of the skull

Aim of the class: to study the structure of anatomical formations of the whole skull.

Motivational characteristics of the topic

This knowledge is necessary for neurosurgeons, neurologists, traumatologists, ophthalmologists, stomatologists, radiologists, otorhinolaryngologists.

Main issues of the topic

1. Neurocranium:
   a) calvaria;
   b) cranial base;
      - external surface of the cranial base;
      - internal surface of the cranial base.
2. Viscerocranium:
   a) orbital cavity;
   b) nasal cavity;
   c) temporal fossa;
   d) infratemporal fossa;
   e) pterygopalatine fossa.
3. Concept of craniometry.
4. Age, gender, individual characteristics of the skull, neonatal skull.
5. X-ray anatomy of the skull.

Information section and recommendations on unsupervised activites

1. When studying the cranial skull, determine the boundary between the calvaria and cranial base, passing from the glabella along the superciliary arches, the base of zygomatic process of the frontal bone, infratemporal crest of the sphenoidal bone, superior nuchal line, external occipital protuberance.
2. When studying the calvaria, find all bones and extreme points of the calvaria (vertex, parietal tubers, forehead, occiput, temple).
3. In doctor's practical work during examination of patients (especially with craniocerebral injuries), it is important to remember and distinguish on X-ray tomograms not only the anatomical formations of the skull bones that you studied earlier. Consider what parts of bones form the topographic formations (fossae, cavities) studied in this topic, and also the boundaries between the bones, as both they and the bone fracture lines have similar sings on the radiograph.

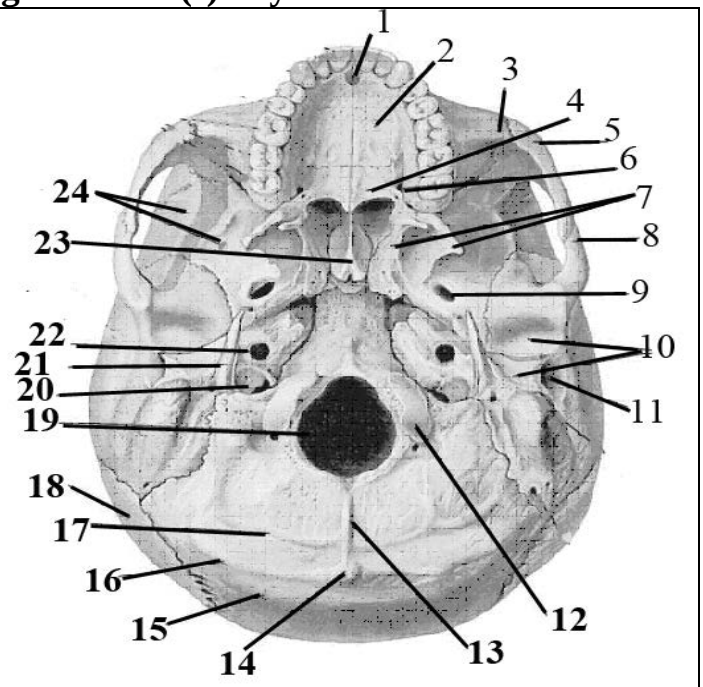
The knowledge of communication (canals, openings) is important between the cavities (fossae) of the skull, because nerves and blood vessels pass through them into the cavity (from the cavities), along which a pathological process (for example, inflammatory) can spread from one cavity to another one.
4. When studying the base of the skull, find the bones that form it. External and internal base should be considered separately.
5. On the external surface of the cranial base show the anterior, middle, and posterior parts. Take into consideration that the front of the external surface of the cranial base is covered by the facial skull. Therefore, we can see the bones that form the upper wall of the oral cavity on preparations of the cranial base. Show here the upper alveolar arch formed by the alveolar processes of both upper jaws and the bony palate (there are a greater palatine foramen and a greater palatine canal, an incisive canal). Show the bones involved in the formation of the middle (anterior to the foramen magnum) and posterior parts of the external surface of cranial base, main anatomical formations, the holes formed when the bones are connected (choanae, foramen lacerum, jugular foramen), messages of the external surface of the cranial base with the cranial cavities.
6. Learn to distinguish anterior, middle and posterior cranial fossae on the internal surface of the cranial base, as well as bones involved in their formation, their borders, basic anatomical formations, communications of the cranial fossae with the cranial cavities.
7. When studying the viscerocranium, find the bones, fossae, and cavities that are formed when these bones are connected (nasal cavity, orbital cavity, temporal, infratemporal, and pterygopalatine fossae).
8. When studying the orbital cavity, find the superior, inferior, medial, lateral walls, the bones that form them, their openings (superior and inferior orbital fissures, optic and nasolacrimal canals, anterior and posterior ethmoidal foramina), communications of the orbit with other cranial cavities.
9. When studying the nasal cavity, find the piriform aperture, choanae, walls (lateral, inferior, superior and posterior), bony nasal septum, the bones and bone parts that form them, superior nasal meatus, middle nasal meatus and inferior nasal meatus, common nasal meatus, paranasal sinuses (sphenoidal sinus, frontal sinus, maxillary sinus, ethmoidal cells), communication of the nasal cavity with other cranial cavities.
10. When studying the temporal, infratemporal and pterygopalatine fossae find their walls, bones that form them, openings and canals which communicate fossae with other cavities.
11. When studying craniometry, find the main craniometric points (glabella, inion, bregma, basion, eurion) and study how to determine indices that are forms of the brain skull (dolichocephalic, mesocephalic, brachycephalic).

12. When studying the age, gender and individual structural features of the skull, pay attention to the ratio of the cranial and facial parts of the skull, the presence of fontanelles, apophyses (tubercles, protuberance, etc.), recesses, the ratio in size and shape of various bones in the neonatal skull (fetus) and adult person.
13. When studying the X-ray anatomy of the skull, learn to read (consider) the X-ray algorithm, computer x-ray and nuclear magnetic resonance imaging, learn to find the boundaries of bones, anatomical formations in bones, airways.
14. Write down the Latin terms in the student's vocabulary list and memorize them.

Visuals: a skull, calvaria, a cranial base, museum preparations, a newborn skull, X-ray of a skull in frontal and lateral projections.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. What number indicates the incisive canal in the figure?
2. What number indicates the greater palatine canal in the figure?
3. What number indicates the jugular foramen in the figure?

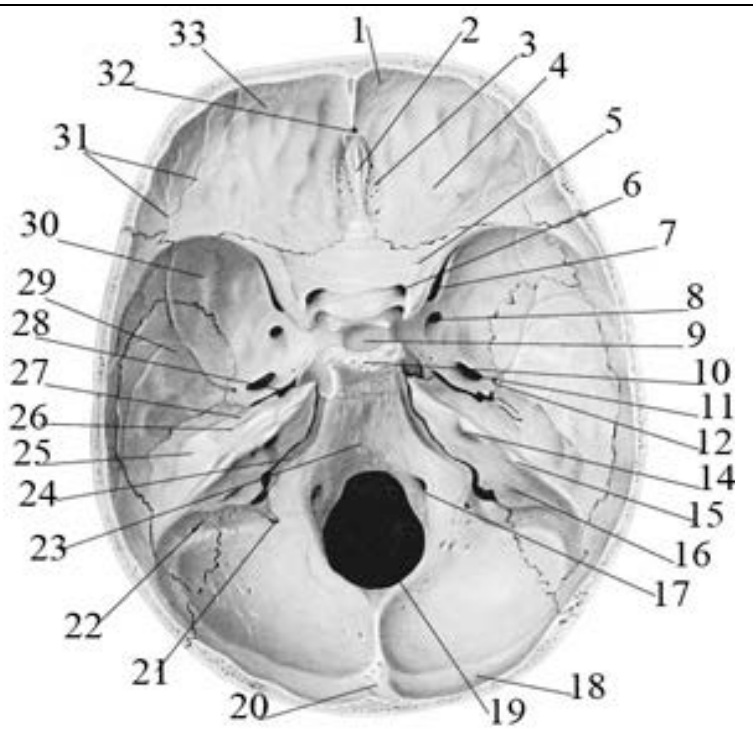


4. What bone surfaces participate in the formation of the calvaria?
   1. Frontal bone.
   2. Ethmoidal bone.
   3. Occipital bone.
   4. Parietal bone.
   5. Temporal bone.
5. What is located in the middle cranial fossa?
   1. Sella turcica.
   2. Clivus.
   3. Carotid sulcus.
   4. Prechiasmatic sulcus.
   5. Arcuate eminence.

6. What number indicates the crista galli in the figure?

7. What number indicates the foramen ovale in the figure?

8. What number indicates the superior orbital fissure in the figure?



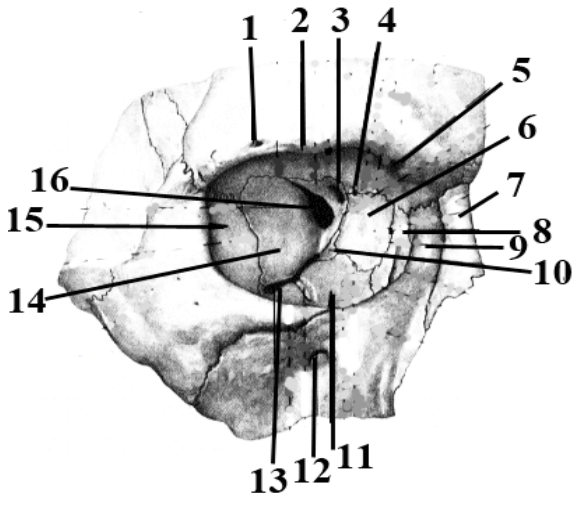
9. What is opened into the middle cranial fossa?
   1. Optic canal.
   2. Hypoglossal canal.
   3. Foramen rotundum.
   4. Foramen ovale.
   5. Foramen spinosum.

10. What groove(s) is are distinguished in the posterior cranial fossa?
   1. Carotid groove.
   2. Groove for inferior petrosal sinus.
   3. Groove for transverse sinus.
   4. Groove for sigmoid sinus.
   5. Groove for superior sagittal sinus.

11. What number indicates the superior orbital fissure in the figure?

12. What number indicates the inferior orbital fissure in the figure?

13. What number indicates the orbital plate of ethmoid in the figure?



14 Which of the following formation(s) is/are involved in the formation of the medial orbital wall?

1. Sphenoidal bone.
2. Ethmoidal bone.
3. Lacrimal bone.
4. Temporal bone.
5. Maxilla.

15. Aperture of the frontal sinus opens through the ethmoidal infundibulum into:

1. Superior nasal meatus.
2. Common nasal meatus.
3. Ethmoidal labyrinth.
4. Superior orbital fissure
5. Middle nasal meatus.

16. Aperture of the maxillary sinus opens into:

1. Superior nasal meatus.
2. Ethmoidal labyrinth.
3. Middle nasal meatus.
4. Inferior nasal meatus.
5. Common nasal meatus.

17. The following sinus(es) is/are opened into the superior nasal meatus:

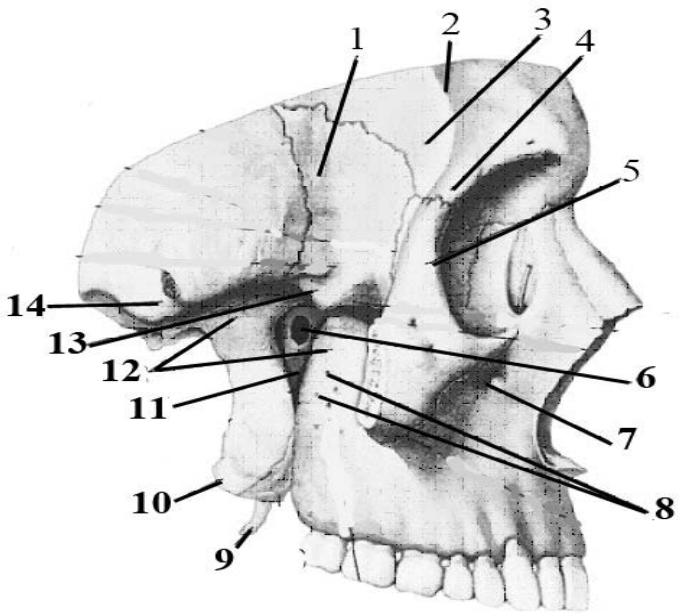
1. Frontal sinus.
2. Sphenoidal sinus.
3. Anterior and middle ethmoidal cells.
4. Maxillary sinus.
5. Posterior ethmoidal cells.

18. The posterior wall of the pterygopalatine fossa is formed by :

1. Infratemporal crest of the sphenoidal bone.
2. Pterygoid process of the sphenoidal bone.
3. Greater wing of the sphenoidal bone.
4. Perpendicular plate of the palatine bone.
5. Body of the sphenoidal bone.

19. What is opened into the pterygopalatine fossa?

1. Superior orbital fissure.
2. Pterygoid canal.
3. Inferior orbital fissure.
4. Greater palatine canal.
5. Sphenopalatine foramen.

20 Which number indicates the temporal fossa in the figure? 21. Which number indicates the infratemporal fossa in the figure? 22. Which number indicates the sphenopalatine foramen in the figure?	

23. Which of the following characteristic(s) of the skull of a newborn is/are incorrect?

1. The brain box is 8 times larger than facial skeletone.
2. The base of the skull is much larger than the calvaria.
3. The frontal bone has of two parts.
4. There are fontanelles in it.
5. The facial skeleton is small.

24. The medial wall of the pterygopalatine fossa is formed by:

1. Pterygoid process of the spenoidal bone.
2. Maxillary tuberosity.
3. Body of the sphenoidal bone.
4. Perpendicular plate of the palatine bone.
5. Sphenoidal process of the palatine bone.

25. Through which canal does the pterygopalatine fossa communicate with the region of the foramen lacerum?

1. Carotid canal.
2. Auditory canal.
3. Facial canal.
4. Pterygoid canal.
5. Hypoglossal canal.

Situational tasks

1. A patient has the permanent lacrimation. Function of the lacrimal gland is not broken. Tear fluid cannot flow into the nasal cavity.

Name through which the anatomical formation tear fluid flows from the orbital cavity into the nasal cavity.

2. A patient complains of pain in the upper jaw, respiratory failure, nasal discharge. The mucous membrane is hyperemic, swollen. The edges of the maxillary sinus are hyperemic. The mucopurulent discharge is visible.

In which nasal meatus do they fall?

3. A teenager got a direct blow on the nose bridge in a street fight. The examination is detected an outflow of a yellowish fluid (cerebrospinal fluid) from the nasal cavity . A fracture of the base of skull is suspected.

Which bone has been broken? Argue your answer.

Memorize the following eponyms

Bisha fossa (M.F.X.Bichat) – pterygopalatine fossa, *fossa pterigopalatina*.

Assignment for students to assess the acquired knowledge of the class topic:

1. Find the calvaria, show the bones that form it, all anatomical formations located on it, the border separating the calvaria from the base of the skull.
2. Find the anterior cranial fossa, show the bones that form it, and all anatomical formations located in it.
3. Find the middle cranial fossa, show the bones that form it and all anatomical formations located in it.
4. Find the posterior cranial fossa, show the bones that form it, and all anatomical formations located in it.
5. Find the temporal fossa, show the bones that form it.
6. Find the temporal fossa, show the bones that form it and all anatomical formations located in it.
7. Find the pterygopalatine fossa, show the bones that form it.
8. Show the communications of the pterygopalatine fossa.
9. Find the bony palate, show the bones that form it and all anatomical formations on it.
10. Find the orbital cavity; show the superior, inferior, medial, lateral walls of the orbital cavity, the bones forming the walls.
11. Show the communications of the orbital cavity.
12. Find the nasal cavity, show its superior, inferior, lateral walls, anatomical formations located on them.
13. Find the nasal cavity, show the bony septum of the nasal cavity, and bones that form it.
14. Show the paranasal sinuses and their communications
15. Show communications of the nasal cavity with pharynx, orbital cavity, pterygopalatine fossa, oral cavity, anterior cranial fossa.
16. Show anatomical formations located on the external surface of the cranial base.
17. Take the skull of a newborn and show on it the differences from the adult skull.

References:

Main:
1. P. 99-116.
2. C. 47-51, 84-110.
3. Рис. (fig.) 4-17.
4. C. 73-82.

Additional:
7. P. 3-39, 43-44.

Topic 8 Final control class on preparations of bones

Aim of the class: to determine the level of academic competencies (knowledge, skills) of students in the functional anatomy of bones, taking into account their importance for the clinic.

Motivational characteristics of the topic

Osteology is the basic section for the study of all subsequent sections of anatomy and clinical disciplines, for work traumatologists, orthopedics, internists, radiologists, etc.

Main issues of the topic

Students should be able to use the general terms of Latin anatomical terminology, determine the location of bones in the skeleton, explain to distinguish the right bone from the left one, name and show the parts of all anatomical formations on the bones.

Student should demonstrate the knowledge of the following issues on preparations and visual aids.

1. The structure of human skeleton:
   - Skeleton of the trunk (vertebrae, ribs and sternum)
   - Bones of the upper limb (shoulder girdle and free part of upper limb)
   - Bones of the lower limb (pelvic girdle and free part of lower limb)
   - Cranium (neurocranium and viscerocranium).

Information section and recommendations on unsupervised activites

1. Refresh information about the structure of the bones of the skeleton according to recommendations proposed in topics №№ 1–7.

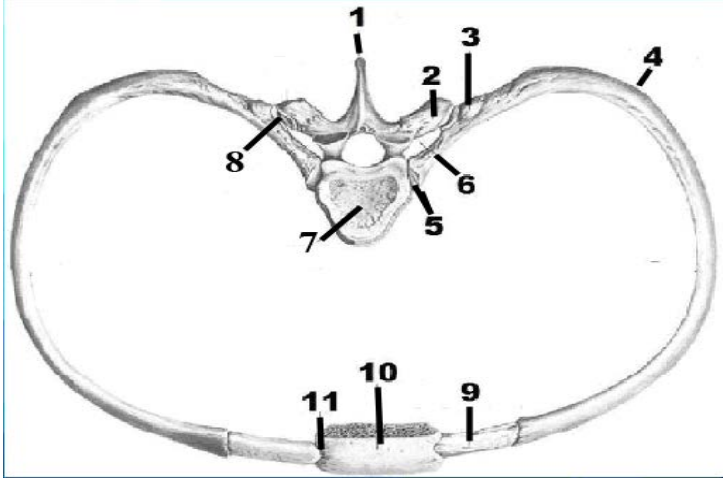
Visuals: a skeleton, a vertebral column, skull, base of the skull, preparations of all bones of the skeleton, museum preparations, a newborn skull, X-ray of all parts of the body in the frontal and lateral projections.

Test questions for self study and self-assessment

or choice the right variant(s) of your answer:

1. Which spinous process is the landmark for understanding the vertebral numbers?
   1. C I.
   2. C V.
   3. C VII.
   4. Th I.
   5. L III.

2. Which edge of the rib should be punctured without the damage of the neurovascular bundle lying in the costal groove?
   1. Latera edge l.
   2. Medial edge.
   3. Superior edge.
   4. Inferior edge.
   5. Posterior edge.

3. Which number indicates the neck of the rib in the figure? 4. Which number indicates the tubercle of the rib in the figure? 5. Which number indicates the angle of the rib in the figure?	

6. What is the rib palpated below the inferior angle of the scapula?
   1. III.
   2. V.
   3. VII.
   4. IX.
   5. X.

7. Which of the folowing formations of the pelvic girdle are available for palpation?
   1. Iliac crest.
   2. Pubic symphysis.
   3. Acetabulum.
   4. Sacro-iliac joint.
   5. Ischial spine.

8. Which opening connects pterygopalatine fossa with the nasal cavity?
   1. Foramen spinosum.
   2. Jugular foramen.
   3. Foramen ovale.

4. Sphenopalatine foramen.
5. Foramen rotundum.

9. Which the following formation connects pterygopalatine fossa with the oral cavity?
1. Pterygoid canal.
2. Greater palatine canal.
3. Carotid canal.
4. Hypoglossal canal.
5. Facial canal.

10. Which of the folowing formations are available for palpation?
1. Lateral and medial malleolus
2. Styloid process.
3. Patella.
4. Tibial tuberosity.
5. Epicondyles of femur.

11. Maxilla articulates with the following bones:
1. Nasal bone.
2. Frontal bone.
3. Sphenoidal bone.
4. Temporal bone.
5. Hyoid bone

12. Foramen lacerum is/are limited by:
1. Temporal bone.
2. Sphenoidal bone.
3. Ethmoidal bone.
4. Occipital bone.
5. Palatine bone.

13. In which cavities can the inflammatory process spread from the nasal cavity through openings in the bones?
1. Pharyngeal cavity.
2. Oral cavity.
3. Middle cranial fossa.
4. Pterygopalatine fossa.
5. Tympanic cavity.

14. Promontory is located:
1. Between LIV and LV.
2. Between LV and sacrum.
3. At the level of the body LV.
4. At the level of S1.
5. Between SV and C1.

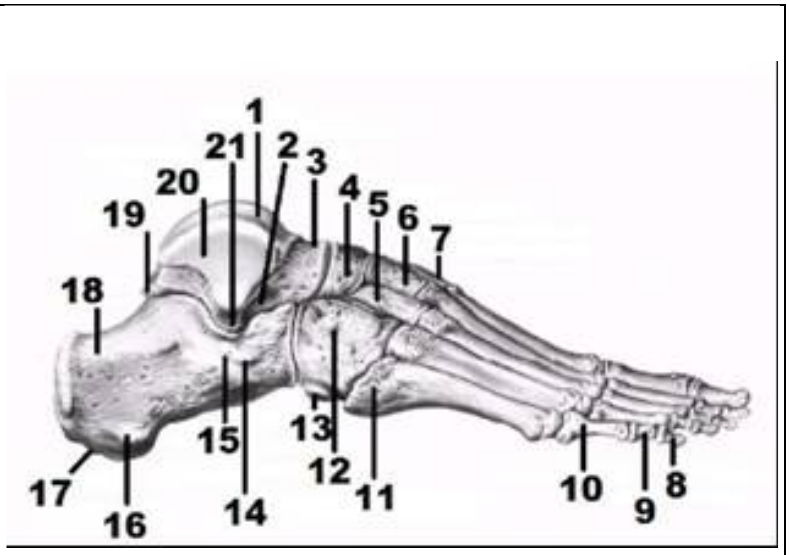
15. Which of the folowing formations are available for palpation on the sternum?
1. Jugular notch.

2. Clavicular notches.
3. Costal notches.
4. Sternal angle.
5. Xiphoid process.

16. Which of the following statements correctly describe the false ribs?
1. The costal groove is located on the lower edge of the internal surface and contains the intercostal blood vessels and nerves.
2. The costal groove is located on the uperr edge of the internal surface and contains the intercostal blood vessels and nerves.
3. Cartilaginous part of ribs is connected by sternum.
4. Cartilaginous part of ribs is connected by upper rib.
5. The ends of ribs lie in the thickness of abdominal muscles.

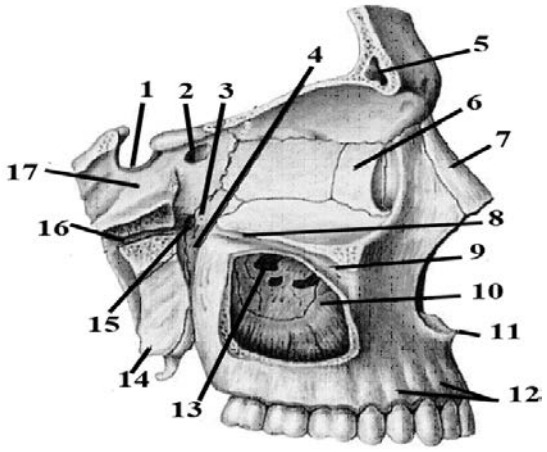
17. Which of the folowing formations are available for palpation on the tibia?
1. Intercondylar eminence.
2. Anterior border.
3. Medial malleolus.
4. Lateral condyle.
5. Tuberosity.

18. The ethmoidal bone articulates with the following bones:
1. Frontal bone.
2. Sphenoid bone.
3. Inferior nasal concha.
4. Vomer.
5. Lacrimal bone.

19. Which number indicates the calcaneal tuberosity in the figure? 20. Which number indicates the trochlea of talus in the figure? 21. Which number indicates the intermediate cuneiform bone in the figure?	

22. Where is the pterygoid fossa located ?
1. Mandible.
2. Maxilla.

3. Hip bone.
4. Scapula.
5. Temporal bone.

23. Which number indicates the pterygoid canal in the figure? 24. Which number indicates the lacrimal bone in the figure? 25. Which number indicates the maxillary sinus in the figure?	

Situational tasks

1. A injured person was diagnosed with a fracture of the base of the skull, slurred speech, asymmetry of the tongue (to the right side). They are the symptoms of the damage at the left hypoglossal nerve in the hypoglossal canal.

In which bone did the fracture line pass through the hypoglossal canal? In which projection of the skull could be seen such a fracture localization on the X-ray?

2. A first-year student suffering from chronic rhinitis had an exacerbation of the disease before the test week. The chronic rhinitis was followed by a high fever and purulent discharge from the nose. When the teacher sent him from class to the clinic, the student with a diagnosis of purulent ethmoiditis was directed to hospital. However, he did not go to the hospital and 2 days later the edema developed in the area of his right eye.

Are there any anatomical connections through which the pus can pass from the cells of the ethmoid bone to the orbital cavity?

A list of questions for final assessment class on the preparations of bones.

Block 1. Show and name in Latin:

1. Orbital surface of the frontal bone.
2. Maxillary surface of the sphenoidal bone.
3. Hypoglossal canal of the occipital bone.
4. Lacrimal bone.
5. Inferior articular process of the thoracic vertebrae.
6. Tubercle of the rib.
7. Trochlea of the humerus.
8. Bone of the hand: trapezium.

9. Ischial spine.
10. Medial (Lateral) intercondylar tubercle of the tibia.
11. Temporal surface of the frontal bone.
12. Infratemporal crest of the sphenoidal bone.
13. Internal occipital protuberance.
14. Condylar process of the mandible.
15. Superior articular process of the lumbar vertebrae.
16. Supraspinous fossa of the scapula.
17. Tubercle of humerus.
18. Greater (Lesser) sciatic notch.
19. Interosseous border of the fibula.
20. Groove for superior sagittal sinus of the frontal bone.
21. Foramen rotundum of the sphenoidal bone.
22. Groove for transverse sinus of the occipital bone.
23. Perpendicular plate of the palatine bone.
24. Transverse foramen of the cervical vertebrae.
25. Superior border of the rib.
26. Spine of the scapula.
27. Anatomical neck of the humerus.
28. Auricular surface of the ilium.
29. Epicondyles of the thigh bone.
30. Supra-orbital notch/foramen of the frontal bone.
31. Pterygoid fossa of the sphenoidal bone.
32. Groove for sigmoid sinus of the occipital bone.
33. Horizontal plate of the palatine bone.
34. Costal facet of the thoracic vertebrae.
35. Clavicular notch of the sternum.
36. Glenoid cavity of the scapula.
37. Olecranon fossa of the humerus.
38. Iliac spine.
39. Apex of head of the fibula.
40. Occipital groove of the temporal bone.
41. Hypophysial fossa of the sphenoidal bone.
42. Crista galli.
43. Maxillary tuberosity
44. Internal surface of the sternum.
45. Infraspinous fossa of the scapula.
46. Coronoid process of the ulna.
47. Process of the frontal bone.
48. Condyles of the femur.
49. Nasal spine of the frontal bone.
50. Opening of the sphenoidal sinus.

51. Pharyngeal tubercle of the occipital bone.
52. Temporal process of the zygomatic bone.
53. Xiphoid process of the sternum.
54. Infraspinous fossa of the scapula.
55. Radial groove of the humerus.
56. Ischial ramus.
57. Lateral malleolus.
58. Superciliary arch.
59. Foramen ovale.
60. Inferior nuchal line of the occipital bone.
61. Frontal process of the zygomatic bone.
62. Spinous process of the lumbar vertebrae.
63. Head of the rib.
64. Acromion of the scapula.
65. Greater tubercle of the humerus.
66. Iliac crest.
67. Soleal line.
68. Carotid sulcus of the sphenoidal bone.
69. Condylar fossa of the occipital bone.
70. Maxillary process of the zygomatic bone.
71. Vertebral arch of the thoracic vertebrae.
72. Sternal angle.
73. Inferior angle of the scapula.
74. Carpal articular surface of the radius.
75. Arcuate line of the ilium.
76. Linea aspera.
77. Granulation foveolae of the parietal bone.
78. Spinous foramen.
79. Jugular tubercle of the occipital bone.
80. Nasal bone.
81. Carotid tubercle of the cervical vertebrae (VI).
82. Jugular notch of the sternum.
83. Conoid tubercle of the clavicle.
84. Trochlear notch of the ulna.
85. Symphysial surface of the pubis.
86. Popliteal surface of femur.
87. The groove for the superior sagittal sinus on the parietal bone.
88. Dorsum sellae of the sphenoidal bone.
89. Alveolar yokes of the maxilla.
90. Vertebral notches.
91. Supraglenoid (Infraglenoid) tubercle.
92. Coronoid fossa of the humerus.

93. Metacarpals [I—V].
94. Gluteal lines of the ilium.
95. Tibial tuberosity.
96. Sphenoidal angle of the parietal bone.
97. Temporal surface of the greater wing
98. External occipital protuberance.
99. Infra-orbital foramen of the maxilla.
100. Impression for costoclavicular ligament
101. Inferior border of the rib.
102. Articular circumference of the radius.
103. Lunate surface of theacetabulum.
104. Patellar surface of the thigh bone.
105. Mastoid angle of the parietal bone.
106. Plates of the pterygoid process.
107. Occipital condyle.
108. Mandibular canal.
109. Tubercles of atlas.
110. Articular facets of the clavicle.
111. Scaphoid bone.
112. Acetabular notch.
113. Trochanteric fossa.
114. Sustentaculum tali (Talar shelf).
115. Trigeminal impression.
116. Anterior clinoid process.
117. Cruciform eminence.
118. Zygomaticofacial foramen.
119. Intermediate sacral crest.
120. Suprascapular notch.
121. Trapezoid line of the clavicle.
122. Iliopubic eminence.
123. Articular surface of the medial malleolus.
124. Neck of talus.
125. Tegmen tympani of the temporal bone.
126. Sphenoidal sinus.
127. Perpendicular plate of the ethmoidal bone.
128. Vomer.
129. Mental spine.
130. Facet for the dens.
131. Costal notches.
132. Lunate bones of the hand
133. Iliac fossa.
134. Mastoid notch.

135. Orbital surface of the sphenoidal bone.
136. Cribriform plate of the ethmoidal bone.
137. Frontal process of the zygomatic bone.
138. Costal groove.
139. Subscapular fossa.
140. Surgical neck of the humerus.
141. Pubic crest.
142. Condyle of tibia.

Block 2

1. Show, name and explain the topography, structure connections of the temporal fossa and infratemporal fossa.
2. Show, name and explain construction of the calvaria.
3. Show, name and explain structure of the hip bone.
4. Show, name paranasal sinuses, their structure and connections.
5. Name and show grooves for sinuses on internal surface of the skull.
6. Show, name and explain features of structure of the cervical vertebrae.
7. Show, name and describe the boundaries, walls and foramina of anterior cranial fossa.
8. Name and show the connections of the orbital cavity.
9. Show, name and describe the boundaries, walls, foramina and connections of posterior cranial fossa.
10. Show, name and explain the structure of the sphenoid bone.
11. Show and explain structure of the carotid canal, facial canal, musculotubal canal of the temporal bone.
12. Show, name bones of the bony nasal septum.
13. Show and name features of the structure of the tarsal bones.
14. Show and explain structure of the canaliculus for chorda tympani, caroticotympanic canaliculi, mastoid canaliculus of the temporal bone.
15. Show, name and explain the structure of the bony palate.
16. Show, name and explain the structure of the bones of the forearm.
17. Show, name the nasal meatuses: their localization, connections.
18. Show, name and describe the structure of the orbital walls.
19. Show, name and describe the structure of the lumbar vertebrae and the sacrum.
20. Show, name and explain the structure of the mandible.
21. Show, name and explain the features of the structure of the carpal bones.
22. Show, name and describe the structure of the parietal bone.
23. Show, name and describe the structure of the bones of the leg.
24. Show, name and describe the structure of the occipital bone.
25. Show, name and describe the structure of the pelvic bone.
26. Show, name and describe the classification and structure of the ribs.

27. Show, name and describe the pterygopalatine fossa: localization, walls, and connections.
28. Show, name and describe the construction of the maxilla.
29. Show, name and explain the structure of the scapula.
30. Show, name and describe the structure of the lateral wall of the nasal cavity.
31. Show, name and describe the structure of the ethmoidal bone.
32. Show, name and describe the structure of the frontal bone.
33. Show, name and describe the construction of the tibia.
34. Show, name and describe the boundaries, walls, foramina and connections of middle cranial fossa.
35. Show, name and explain the structure of the temporal bone.
36. Show, name and explain the external surface of the cranial base.
37. Show, name and describe the structure of the walls of the nasal cavity.
38. Show, name and describe the posterior cranial fossa, its borders, connections.
39. Show, name and describe the pterygopalatine fossa.
40. Show, name and describe the canals of the temporal bone.
41. Show, name and describe the structure of the sphenoid.
42. Classification of the bones.
43. Development of the upper and lower limbs.
44. Bone as an organ: development, structure, growth.
45. Chemical composition of the bone and its physical properties.
46. Structure of the bones in the X-ray image.
47. Development of the facial skull in ontogenesis.
48.Development of the neurocranium in ontogenesis.
49. Pharyngeal arches and their derivatives
50. Age, sexual and individual features of the skull.
51. Periosteum. Types of the ossification.
52. Skull of the newborn. Age peculiarities of the skull.
53. Development of the axial skeleton in ontogenesis.

References:

Main:

1. P. 3-129.
2. C. 10-164.
3. Рис. (fig.) 4-21,153-157,183,184,330-334,404, 422,439,440,443,444,473-478,500-502,511-513.
4. P. 5-96.

Additional:

5. P. 2-31, 187-208.
6. P. 6-39.
7. P. 3-43.

Topic 9 Connections between the bones. Classification, general

structure and principles of functioning. Connections of the skull bones and trunk. Vertebral column & Thorax as a whole

Aim of the class: to study biomechanical and anatomical classification; to understand differences between all types of joints (synarthrosis, diarthrosis); to study the functional anatomy of the cranial, vertebral, thoracic joints; students should be able to find, name and show anatomical structures on preparations; students should be able to demonstrate possible movements of joins.

Motivational characteristics of the topic

Knowledge of general and particular functional anatomy of joints is necessary for understanding and studying all human body articulations, for further studying skeletal muscles. The knowledge about the structural features of joints is essential in traumatology and orthopedics, neurology, surgery, radiology, trauma surgeons, radiologists and speech orthopedics, maxillofacial surgery, for diagnosis and treatment of diseases and injuries of the locomotion apparatus.

Main issues of the topic

1. Arthrology as a science. Classification of articulations:
   a) Synarthrosis: types, general characteristic;
   b) Synovial joint (diarthrosis): general characteristic. Biomechanics of joints;
   c) Classification of the synovial joints.
2. Joints of theskull:
   a) cranial sutures, cranial synchondroses, cranial synostosis, dento-alveolar syndesmosis (gomphosis);
   b) temporomandibular joint.
3. Joints of the trunk.
   3.1. Vertebral joints:
   a) joints between the bodies of the vertebrae;
   b) joints between the arches of vertebrae, joints between the transverse and spinous processes;
   c) zygapophysial joints;
   d) sacrococcygeal joint.
   3.2. Joints between the vertebral column and the skull:
   a) atlanto-occipital joint;
   b) atlantoaxial joints (middle and lateral).
4. Vertebral column as a whole and the formation of the spinal curvatures.
5. Costovertebral joints: classification, anatomical and functional characteristic.
6. Sternocostal joints.

7. Intercartilaginous joints.
8. Thoracic cage as a whole.

Information section and recommendations on unsupervised activites

1. The study of "anatomy of joints (arthrology)" should begin with keeping in mind, that all joints in the human body are divided into synarthrosis and diarthrosis ones; it is necessary to realize what anatomical and functional differences belong to each of them. You should consider that synovial joints have main components and additional structures, you should be able to characterize each of them. Characterizing biomechanics of the synovial joints should begin with the construction of the model of studied joints on bones and also, you should be able show the movements of the synovial joints on your own body. Characterize the motions in the joint around the axis and demonstrate them on your own body using a pointer (pen, pencil).
2. Firstly, we recommend to determine the type of the joint (synarthrosis or diarthrosis).
3. When studying the anatomy of synarthrosis, we recommend you to use the following scheme:

a) make the model of studied joints on bones or show them on a skeleton, vertebral column, skull, pelvis.
b) name the synarthrosis joint (in English and in Latin).),
c) determine the type of synarthrosis (syndesmosis, synchondrosis (symphyses), synostosis),
d) determine the type of syndesmosis,
e) determine the anatomical structures that strengthen the joint (for symphysis).

4. When studying the anatomy of synovial joints, we recommend to use the following scheme:

1) Make the model of the synovial joint using separate bones.
2) Name the synovial joint (in English and in Latin).
3) Characterize the main (principal) elements of the joint:
   a) determine the number of the articular surfaces;
   b) identify the place of attachment of the articular capsule on the bones;
   c) determine: Is it a combined joint?;
   d) determine the shape of the articular surfaces (cylindrical joint, pivot joint, hinge joint, bicondylar joint, saddle joint, spherical joint, cotyloid joint, plane joint);
4) pay attention to the possible movements of joints, take into consideration that there are three types of synovial joints according biomechanical classification: uniaxial joint, biaxial joint and multiaxial joint.
5) Characterize the auxiliary formations of the joints:
   a) intra-articular elements (disks, menisci, lips, ligaments, synovial folds, bursa);

b) determine: Is it a complex joint?;

c) find the extra articular elements;

6) Demonstrate all movements, that are possible in the joint and determine the using axes.

5. When studying the cranial synarthrosis, find the serrate sutures (coronary, sagittal and lambdoid), squamous suture, plane sutures (between the bones of the facial skull), gomphosis (dentoalveolar connection), spheno-occipital, spheno-petrosal and petro-occipital synchondroses .

6. When studying the temporomandibular joint, you should find the following formations: articular disc, articular capsule, lateral, spheno-mandibular, stylo-mandibular ligaments. Study the characteristics of each movement of temporomandibular joint.

7. When studying the joints between the bones of the vertebral column and the skull, students should find the following formations on natural preparations: atlanto-occipital and atlanto-axial joints, anterior and posterior atlanto-occipital and tectorial membrane, cruciate ligament of atlas, alar ligament and apical ligament of dens.

8. When studying the vertebral joints, you should be able to find continuous (synchondrosis, synostosis) and discontinuous joints.

a) When studying the joints between the bodies of the vertebrae, find intervertebral discs and its parts (annulus fibrosus, nucleus pulposus), anterior and posterior longitudinal ligaments.

b) When studying the joints between the arches of vertebrae and joints between the transverse and spinous processes, find the following formations on natural preparations: interspinous ligaments, ligamenta flava, intertransverse ligaments, supraspinous ligament, ligamentum nuchae and zygapophysial joints.

c) Find the following formations on natural preparations: lumbosacral and sacrococcygeal joints, identify their ligaments (iliolumbar ligament, superficial posterior sacrococcygeal ligament, deep posterior sacrococcygeal ligament, anterior sacrococcygeal ligament, lateral sacrococcygeal ligament).

9. When studying a vertebral column as a whole, find the following curvatures: thoracic kyphosis, sacral kyphosis, cervical lordosis, lumbar lordosis and scoliosis. Explain the reasons of their formation.

10. When studying the joints between the ribs and the vertebrae, find combined costovertebral joint (joint of the head of the rib, costotransverse joint) and ligaments which strengthen them (radiate and intraarticular ligaments of the head of the rib, costo-transverse ligaments).

11. When studying the joints between the ribs and the sternum, identify the following formations: intra-articular sternocostal ligament, radiate sternocostal ligaments, sternal membrane, costosternal joint, synchondrosis of first rib, xiphisternal joint, manubriosternal joint.

12. When studying the thoracic cage as a whole, determine the shape of the thoracic cage and find the following formations: superior thoracic aperture, inferior thoracic aperture, costal arch, intercostal space, infrastemal angle.
13. Write down in the working dictionary and memorize the Latin terms.

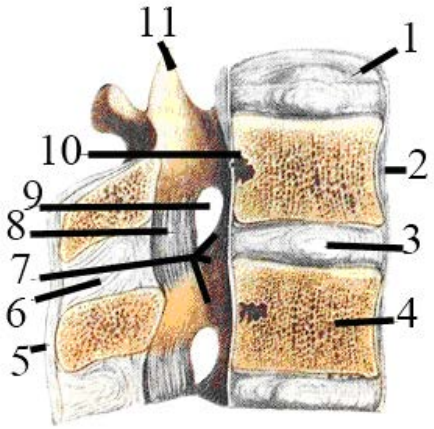
Visuals: skeleton, vertebral column, skull, ribs, natural joints of skull and thorax.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

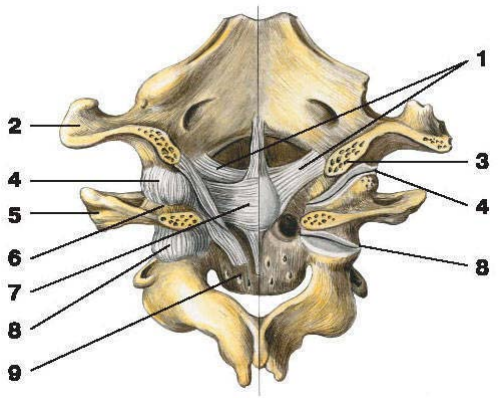
1. What are the main components of the joints?
    1. Articular surface.
    2. Articular disc.
    3. Articular cavity.
    4. Articular capsule.
    5. Articular labrum.
2. What is/are the feature(s) of the complex joint?
    1. Articular labrum.
    2. Articular cartilage.
    3. Articular disc.
    4. Intra-articular ligament.
    5. Synovial bursa.
3. Which of the following joint(s) is/are uniaxial?
    1. Hinge joint.
    2. Bicondylar joint.
    3. Saddle joint.
    4. Ellipsoid joint.
    5. Plane joint.
4. Which of the following joint(s) is/are biaxial?
    1. Cylindrical joint.
    2. Hinge joint.
    3. Ellipsoid joint.
    4. Plane joint.
    5. Spheroidal joint.
5. Which of the following joint(s) is/are multiaxial?
    1. Cylindrical joint
    2. Saddle joint
    3. Plane joint
    4. Hinge joint
    5. Bycondylar joint.

6. Which of the following continuous articulation(s) is/are fibrous joints?
    1. Intervertebral disc.

2. Frontal fontanelle.
3. Ligamenta flava.
4. Interosseous membrane.
5. Lambdoid suture.

7. Which number indicates the annulus fibrosus in the figure? 8. Which number indicates the ligamentum flava in the figure? 9. Which number indicates the posterior longitudinal ligament in the figure?	

10. Which of the following formation(s) is/are the permanent synchondrosis?
    1. Spheno-occipital synchondrosis.
    2. Sphenopetrosal synchondrosis.
    3. Petro-ocipital synchondrosis.
    4. Petromastoid fissure.
    5. Petrosquamous fissure.

11. Which number indicates the alar ligaments in the figure? 12. Which number indicates the cruciate ligament of atlas in the figure? 13. Which number indicates the articular capsule of the lateral atlanto-axial joint in the figure?	

14. When does the posterior fontanelle close since birth?
    1. In 2 months since birth
    2. In 4 months since birth
    3. In 6 months since birth
    4. In 10 months since birth
    5. In 2 years since birth.

15. Which of the following structures participate in the retention of the dens of the atlas of the median atlanto-axial joint?

1. Apical ligament of dens.
2. Longitudinal bands.
3. Transverse ligament of atlas.
4. Alar ligaments.
5. Tectorial membrane.

16. Intra-articular ligament of the head of the rib is not presented in the following joints of head of rib.

1. 1^{st}.
2. 3^{d}.
3. 5^{th}.
4. 7^{th}.
5. 9^{th}.

17. A kyphosis is located in:

1. Cervical region of the vertebral column
2. Thoracic region of the vertebral column
3. Lumbar region of the vertebral column
4. Coccygeal region of the vertebral column
5. Sacral region of the vertebral column.

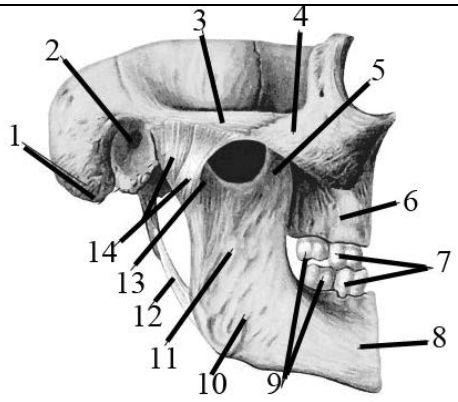
18. A scoliosis is most often formed in:

1. Cervical region of the vertebral column
2. Thoracic region of the vertebral column
3. Lumbar region of the vertebral column
4. Coccygeal region of the vertebral column
5. Sacral region of the vertebral column.

19. Which number indicates the coronoid process of the mandible in the figure?

20. Which number indicates the lateral ligament in the figure?

21. Which number indicates the stylomandibular ligament in the figure?



22. Which of the following curvatures of the vertebral column is non-physiological?

1. Cervical lordosis.
2. Thoracic kyphosis.
3. Lumbar kyphosis.
4. Lumbar lordosis.
5. Coccygeal kyphosis.

23. What is the shape of the thorax in rickets?
1. Wide hape.
2. Plane shape.
3. Pigeon or chiken shape.
4. Cylindrical shape.
5. Conical shape.

24. Which of the following formations correspond to the level of the sternal angle?
1. 1st rib.
2. 2nd rib.
3. Sternal end of the clavicle.
4. 3d rib.
5. 4th rib.

25. Does the fifth thoracic vertebra participate in the formation of?
1. 4 synovial joints.
2. 6 synovial joints.
3. 8 synovial joints.
4. 10 synovial joints.
5. 12 synovial joints.

Situational tasks

1. Dislocation of the atlantoaxial joint is deadly dangerous.
Why? Explain using the anatomical point of view.
2. A patient has the arteriolar prolapse of the intervertebral disc.
Which ligament is most likely damaged?
3. When a group of students was camping, one of the students fell and dislocated a lower jaw.
Can the dislocated jaw be successfully positioned into its normal position by yourself? Why?

Assignment for students to assess the acquired knowledge of the class topic:

1. Synarthrosis: types, general characteristic. Give examples.
2. The classification of the joints based on the shape of the articular surfaces. Give examples.
3. The biomechanical classification of the joints. Give examples.
4. Symphyses. Give examples.
5. What are the main components of the joints? Show them.
6. What are the additional structures of the joints ? Show them.
7. Show the cranial syndesmoses.
8. Show the cranial synchondroses. Indicate the temporary synchondroses.
9. Show the temporomandibular joint and describe its anatomical and functional characteristics.

10. Show the median atlanto-axial joint and describe its anatomical and functional characteristics.
11. Show the lateral atlanto-axial joint and describe its anatomical and functional characteristics.
12. Show the synarthroses of the vertebral column.
13. Show the vertebral synovial joints and describe the anatomical and functional characteristics of the zygapophysial joints.
14. Show the vertebral curvatures and explain the timing and reasons of their formation.
15. Show the sternocostal joints and describe their anatomical and functional characteristics.
16. Show the costovertebral joints and describe their anatomical and functional characteristics.
17. Show the thorax, superior thoracic aperture, inferior thoracic aperture on the skeleton. Enumerate the structures which form the thorax.

References:

Main:
1. P. 129-148.
2. C. 165-190.
3. Рис. (fig.) 18, 21-23,155-159,183,184,243.
4. P. 98-123.

Additional:
5. P. 187-192,196-214.
6. P. 183-190.
7. P. 3-43,150-151, 34-36, 73-75.

Topic 10 Joints of the upper limb

Aim of the class: to study the structure of joints of the clavicle, scapulae, shoulder and elbow joints, joints of bones of forearm and hand, the structure of the hand as a whole.

Motivational characteristics of the topic

The knowledge of the functional anatomy of the upper limb joints is the basis for understanding the mechanisms of their dislocations, injuries, principles and methods of their conservative and surgical treatment in the practice of traumatology, orthopedics, sports medicine, physiotherapy, rheumatology, etc.

Main issues of the topic

1. Joints of the shoulder girdle:
   a) sternoclavicular joint, its ligaments;
   b) acromioclavicular joint, features of its structure, ligamens;
   c) syndesmoses of shoulder girdle.
2. Joints of the free upper limb:

a) shoulder joint: structural features, ligaments, anatomical and functional characteristics;
b) elbow joint: structural features, ligaments, anatomical and functional characteristics;
c) joints of forearm (syndesmosis and synovial joints);
d) wrist joint: structural features, ligaments, anatomical and functional characteristics;
d) joints of hand: structural featuresligaments, anatomical and functional characteristics;

Information section and recommendations on unsupervised activites

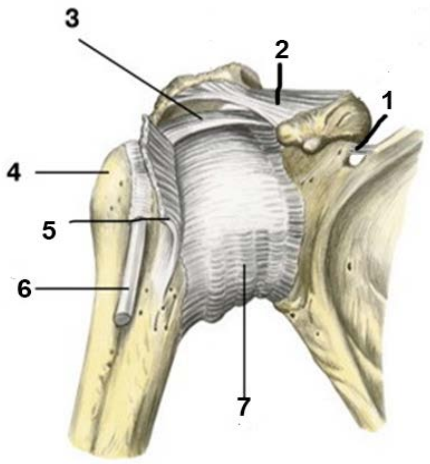
1. Find the sternoclavicular joint, its articular disc and ligaments (anterior and posterior sternoclavicular, costoclavicular and interclavicular ligaments).
2. When studying the joint the clavicle with the scapula, find the acromioclavicular joint, its articular disk and ligaments that strengthen this joint (acromioclavicular, coracoclavicular ligaments).
3. When studying the syndesmoses of the shoulder girdle, find the coracoacromial, superior and inferior transverse scapular ligaments.
4. When studying the shoulder joint, find the glenoid labrum and coracohumeral ligament on natural preparations.
5. When studying the elbow joint, find the joints that form it (humero-ulnar, humeroradial, proximal radio-ulnar) and their ligaments (ulnar and radial collateral ligaments and anular ligament of radius).
6. When studying the joints of the forearm, find the distal and proximal radioulnar joints, the interosseous membrane of the forearm, and the oblique cord.
7. When studying the wrist joint, find the disc and ligaments that strengthen the joint (ulnar and radial collateral ligaments of the wrist, palmar and dorsal wrist ligaments).
8. When studying the joints of the hand, find midcarpal, intercarpal joints, pisiform joint, carpometacarpal, metacarpophalangeal, interphalangeal joints and their following ligaments:interosseous, dorsal and palmar intercarpal, radiate carpal, pisohamate and pisometacarpal, dorsal, palmar and interosseous metacarpal, collateral and palmar ligaments of metacarpophalangeal and interphalangeal joints.
9. Find the transverse ligament (flexor retinaculum), carpal tunnel and ulnar canal, the firm base of hand, learn to find and identify sesamoid bones.
10. Using the algorithm, learn how to read the X-ray of the joints of the upper limb (frontal and lateral projections), know how to find the required components (joint surfaces and cavities) of joints.
11. Be able to show on preparations the anatomical formations of joints, accessible palpations on a living person.

12. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation № 1-11 of this block.

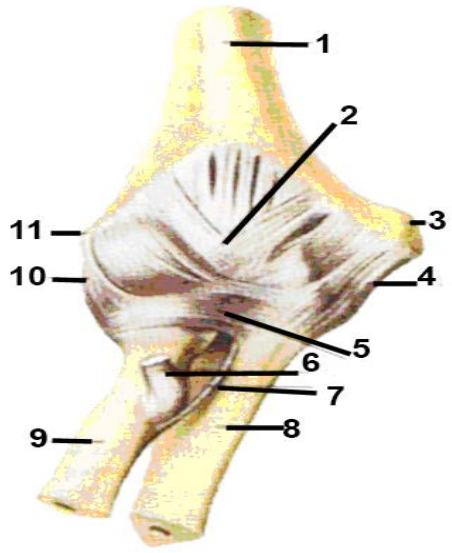
Visuals: skeleton, bones of the superior limb, natural samples and radiographs of joints of the upper limb, imitations, tables.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Which ligaments play the main role in building the sternoclavicular joint?
   1. Lig. interclaviculare.
   2. Lig. coracoclaviculare.
   3. Lig. sternoclaviculare anterius.
   4. Lig. costoclaviculare.
   5. Lig. sternoclaviculare posterius.
2. What are syndesmoses of the shoulder girdle?
   1. Lig. transversum scapulae superior.
   2. Lig. transversum scapulae inferior.
   3. Lig. trapezoideum.
   4. Lig. coracoacromiale.
   5. Lig. coracoclaviculare.
3. Which of the following statements are/is correct about the acromioclavicular joint?
   1. It is firmed by intracapsular ligaments.
   2. An articular disc occurs in 1-3 cases.
   3. It is firmed by the acromioclavicular ligament.
   4. It is firmed by the trapezoid ligament.
   5. It is firmed by the conoid ligament.
4. Which of following statements are/is correct about the sternoclavicular joint?
   1. It has the disc.
   2. It is firmed by the intracapsular ligaments.
   3. It is firmed by the posterior sternoclavicular ligament.
   4. It is firmed by the anterior sternoclavicular ligament.
   5. It is firmed by interclavicular ligament.
5. Which of the following statements are/is correct about the shoulder joint?
   1. It has an ellipsoid shape.
   2. It has the labrum.
   3. It has the intertubercular synovial sheath.
   4. It has the subtendinous bursa of subscapular muscle.
   5. The capsule of the joint is thin.

6. Which number indicates the coracoacromial ligament in the figure? 7. Which number indicates the superior transverse scapular ligament in the figure? 8. Which number indicates the coracohumeral ligament in the figure?	

9. Which of the following statements are/is correct about the elbow joint?
   1. It is the multiaxial joint.
   2. It is the compound joint.
   3. It is the saddle joint.
   4. It is the amphiarthrosis.
   5. It is the cotyloid joint.

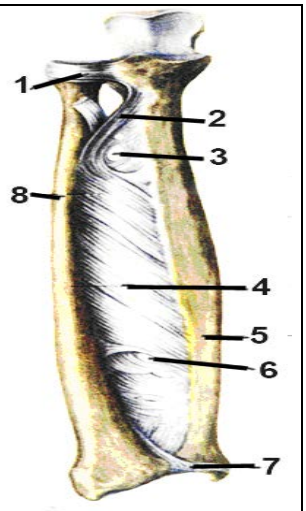
10. Which number indicates the radial collateral ligament in the figure? 11. Which number indicates the anular ligament of radius in the figure? 12. Which number indicates the ulnar collateral ligament in the figure?	

13. Indicate the shape of the humero-ulnar joint.
    1. Spheroidal shape.
    2. Ellipsoid shape.
    3. Plane shape.
    4. Hinge shape.
    5. Saddle shape.
14. A distal radio-ulnar joint and a proximal radio-ulnar joint are:
    1. Hinge joints.
    2. Spheroidal joints.
    3. Combined joints.
    4. Cylindrical joints.
    5. Complex joints.

15. Which number indicates the oblique cord in the figure?

16. Which number indicates the distal radioulnar joint in the figure?

17. Which number indicates the interosseous membrane of the forearm in the figure?



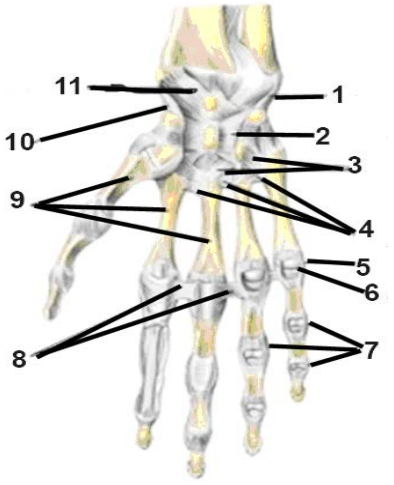
18. Acording to the articular surfaces shape, the radiocarpal joint is:
    1. Spheroidal joint.
    2. Ellipsoid joint.
    3. Nut-shaped joint.
    4. Bicondylar joint.
    5. Hinge joint.

19. Name axes of the movements in the radiocarpal joint?
    1. Frontal and vertical axes.
    2. All axes.
    3. Sagittal and vertica axes.
    4. Sagittal and frontal axes.
    5. Vertical axis.

20. Which number indicates the ulnar collateral ligament of wrist joint in the figure?

21. Which number indicates the palmar radiocarpal ligament in the figure?

22. Which number indicates the interosseous metacarpal ligaments in the figure?



23. What is the shape of the carpometacarpal joint of thumb?
    1. Spheroidal joint.
    2. Ellipsoid joint.
    3. Saddle joint.
    4. Bicondylar joint.
    5. Hinge joint.

24. What is the shape of the metacarpophalangeal joints?
    1. Spheroidal joint.
    2. Ellipsoid joint.
    3. Saddle joint.
    4. Bicondylar joint.
    5. Hinge joint.
25. What is the shape of the interphalangeal joints of the hand?
    1. Spheroidal joint.
    2. Ellipsoid joint.
    3. Saddle joint.
    4. Bicondylar joint.
    5. Hinge joint.

Situational tasks

1. A 43-year-old man felt a severe pain localized in his left shoulder joint after falling on an outstretched arm. The trauma specialist revealed a forced position (in the abduction state) of the left upper limb, which the patient supports by the forearm. He can not perform the passive movements of the left shoulder joint and has the symptom of “elastic fixation”. The head of the humerus is not determined in a typical place. The movements and sensitivity of the fingers are saved.

What is your suspected diagnosis? Does the patient need immobilization of the upper limb?

2. A patient is a victum of the traffic accident. He can perform the passive abduction and adduction movements in the elbow joint.

What is your suspected diagnosis? Does the patient need immobilization of the upper limb?

3. It is known that in time bending the forearm in the elbow joint, there is a slight deviation of the forearm to the medial side. Therefore, the hand does not lie on the shoulder joint, but on the chest

What is the reason for this feature of the joint? Explain the reason for this.

Assignment for students to assess the acquired knowledge of the class topic:

1. Show continuous joints of pectoral girdle.
2. Show the sternoclavicular joint, form this joint, give its general anatomical and functional characteristics.
3. Show the acromioclavicular joint, form this joint, give its general anatomical and functional characteristics.
4. Show the shoulder joint, form this joint, give its general anatomical and functional characteristics.
5. Show the elbow joint, form this joint, give its general anatomical and functional characteristics.

6. Show the forearm joints, form them and give their general anatomical and functional characteristics.
7. Show the wrist joint, form this joint, give its general anatomical and functional characteristic.
8. Show the intercarpal joints, give their general anatomical functional characteristics.
9. Show the carpometacarpal joints, give their general anatomical functional characteristics.
10. Show the metacarpophalangeal joints, give their general anatomical and functional characteristics.
11. Show interphalangeal joints, give their general anatomical and functional characteristics.

References:

Main:
1. P. 148-159.
2. C. 191-214.
3. Рис. (fig.) 408,422-425,439-445.
4. P. 124-137.

Additional:
5. P. 6-31.

Topic 11 Joints of the lower limb

Aim of the class: to study the connections of the pelvic bones, the hip joint, and the structure of the pelvis as a whole, to study the construction and functions of the knee joint, articulations of the leg bones, the ankle joint and joints of the foot

Motivational characteristics of the topic

Knowledge of the structure of the pelvis as a whole, the joints of its bones, the basic size of the pelvis in women is necessary to predict the course of labor. Knowledge of the functional anatomy of the joints of the lower limb is the basis for understanding the mechanisms of their dislocation, damage, principles and methods of their conservative and surgical treatment in the practice of traumatology, orthopedics, rheumatology, sports medicine and physiotherapy.

Main issues of the topic

1. Joints of pelvic girdle.
2. Joints between the bones of the pelvic girdle and the vertebral column.
3. The pelvis as a whole.
4. Features of the female pelvis and its measurements.
5. Hip joint.

6. Knee joint.
7. Joints between the bones of the leg.
8. Ankle joint.
9. Anatomical and surgical joints of the foot.
10. Foot as a whole.

Information section and recommendations on unsupervised activites

1. When studying the joints of the pelvic girdle, take into account that all the types of joints are presented. Find the syndesmosis of the pelvic girdle, symphysis, synostosis, synchondrosis and diarthrosis.
2. When studying the pubic symphysis, find the interpubic disc, upper and ilower pubic ligaments.
3. Find the sacrotuberous and sacrospinous ligaments, obturator membrane on wet preparations of the pelvis.
4. When studying the joints between the bones of the pelvic girdle and the vertebral column, find the sacro-iliac joint and its ligaments (anterior, interosseous and posterior sacro-iliac, iliolumbar).
5. When studying the pelvis as a whole, find the greater pelvis and lesser pelvis, the border between them (linea terminalis), the pelvic cavity, its entrance and exit (pelvic inlet and pelvic outlet), lesser sciatic foramen and greater sciatic foramen, obturator canal.
6. While studying the female pelvis, you should know the following sizes of the greater pelvis and lesser pelvis:

– dimensions of the greater pelvis (3 transverse and 1 straight):

1) Interspinous distance (distantia interspinosa) is the distance between the two anterior superior iliac spines is 25–26 cm.
2) Intercristal dictance (distantia intercristalis) is the distance between the most distant parts of the iliac crests is 28-29 cm.
3) Intertrochanteric distantce (distantia intertrochanterica) is the distance between the right greater trochanter and left greater trochanter is 30-31 cm.
4) External conjugate (conjugata externa) is the distance from the fossa between the spinous process of the V lumbar vertebra and I sacral vertebra (the center of the lumbar rhombus) to the middle of the front (outer) surface of the pubic symphysis is 20-21 cm.

– dimensions of the lesser pelvis*:*

1) Anatomical conjugate (conjugata anatomica) is the distance between the promontorium of the sacrum and the upper edge of the pubic symphysis is 11.5 cm.
2) True (or gynecological) conjugate (conjugata vera) is the distance between the promontory of the sacrum and the most protruding posterior point of the pubic symphysis, equal to 11 cm.

3) Diagonal conjugate (conjugata diagonalis) is the distance between the promontory the sacrum and the lower edge of the pubic symphysis is 12.5-13 cm.

7. When studying the hip joint, find the place of attachment of its capsule on the femur, acetabular labrum and its ligaments that firm the joint (zona orbicularis, iliofemoral, ischiofemoral, pubofemoral, transverse acetabular ligaments, ligament of head of femur) on wet preparations.

8. While studying the main elements of the knee joint, it is necessary to pay attention to the construction of the knee joint (the knee joint permits flexion and extension about a frontal axis, as well as a slight rotation about the axis of the shin in the flexed position).

9. When studying the intraarticular additional elements of the knee joint, find the lateral and medial menisci, transverse ligament of the knee, anterior cruciate ligament and posterior cruciate ligament, and the infrapatellar synovial and alar folds.

10. While studying extraarticular additional elements of the knee joint, find the fibular and tibial collateral ligaments, oblique and arcuate popliteal ligaments and patellar ligament.

11. When studying the knee joint, it is also necessary to determine the location of the following synovial bursae: subcutaneous prepatellar bursa, subfascial prepatellar bursa, subtendinous prepatellar bursa, suprapatellar bursa and deep infrapatellar bursa.

12. While studying the joints between the bones of the leg, find the interosseous membrane, the tibiofibular joint (superior tibiofibular joint), tibiofibular syndesmosis and ligaments firming them (anterior and posterior ligaments of fibular head, anterior and posterior tibiofibular ligaments).

13. When studying the ankle joint, find the “fork” of the joint and elements which participate its formation. Determine its ligaments: medial (deltoid) ligament and lateral ligament which is formed by anterior and posterior talofibular ligaments, calcaneofibular ligament.

14. When studying the joints of the tarsal bones, find the surgical joints: Chopart’s joint, Lisfranc’s joint, and ligaments which are called the keys of these joints (bifurcate ligament and medial cuneometatarsal interosseous ligament). Determine the following joints: subtalar joint, talocalcaneonavicular joint, cuneonavicular joint, intercuneiform joints, and their ligaments.

15. Find the intermetatarsal, metatarsophalangeal, and interphalangeal joints and their ligaments (deep transverse metatarsal ligament, plantar ligaments, and collateral ligaments).

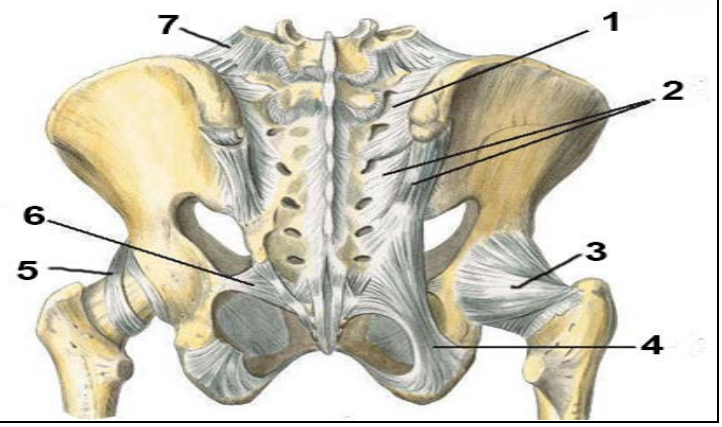
16. When studying the foot as a whole, find the points of support, longitudinal and transverse arches. Identify passive and active formations, which support the arches of the foot.

17. Learn to analyze (read) radiographs (direct and lateral projections) of all joints of the lower limb, find the main elements of joints (articular surfaces and cavities) on them.
18. Learn to show on the preparations all anatomical formations of the joints of the bones of the inferior limb, accessible palpations in a living person.
19. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation № 1-18 of this block.

Visuals: a skeleton, bones of the lower limb, the pelvis as a whole, wet preparations and X-ray of the lower limb, relief models, tables.

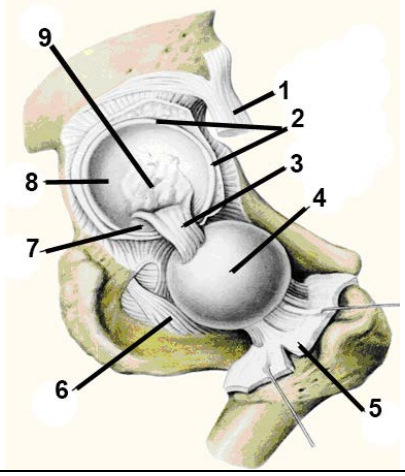
Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Which number indicates the sacrospinous ligament in the figure?
2. Which number indicates the iliolumbar ligament in the figure?
3. Which number indicates the ischiofemoral ligament in the figure?



4. Where does/do the border (Linea terminalis) between the greater pelvis and lesser pelvis run?
   1. Promontorium.
   2. Arcuate line.
   3. Lower gluteal line.
   4. Obturator groove.
   5. Pubic crest.
5. The pelvic outlet is bordered by the following formations:
   1. Sacrotuberous ligament.
   2. Sacrospinous ligament.
   3. Interpubic disc.
   4. Ramus of iscbium.
   5. Inferior pubic ligament.
6. What is the smallest normal size of the gynecological (true) conjugate?
   1. 5 sm.
   2. 7 sm.
   3. 9 sm.
   4. 11 sm.
   5. 15 sm.

7. Which of the following statement(s) are/is correct about the hip joint?
   1. It is strengthened by strong ligaments.
   2. It is surrounded by strong muscles.
   3. It rarely has dislocations.
   4. It is a cotiloid joint.
   5. It has a meniscus.

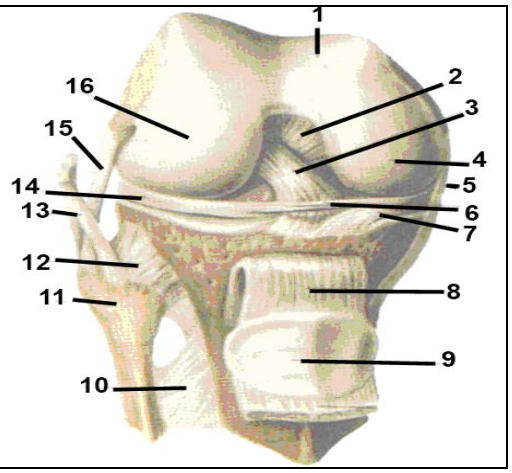
8. Which number indicates the acetabular labrum in the figure? 9. Which number indicates the obturator membrane in the figure? 10. Which number indicates the ligament of head of femur in the figure?	

11. What is the shape of the knee joint?
   1. Hinge shape.
   2. Ellipsoid shape.
   3. Bicondylar shape.
   4. Plane shape.
   5. Saddle shape.
12. Which of the following formations has the knee joint?
   1. Intracapsular ligaments.
   2. Meniscus.
   3. Intracapsular tendons.
   4. Synovial bursae.
   5. Alar folds.
13. What does the posterior cruciate ligament connect?
   1. Femur and fibula
   2. Femur and patella.
   3. Femur and hip bone.
   4. Femur and tibia.
   5. Hip bone and sacrum.
14. Which of the following statement(s) are/is correct about the knee joint?
   1. The fibular collateral ligament is a part of the articular capsule.
   2. The medial meniscus has a lunar shape.
   3. Menisci are connected by a transverse ligament.
   4. It has a patellar bursa.
   5. There is a subcutaneous prepatellar bursa.

15. Which number indicates the lateral meniscus in the figure?

16. Which number indicates the anterior cruciate ligament in the figure?

17. Which number indicates the anterior ligament of fibular head in the figure?

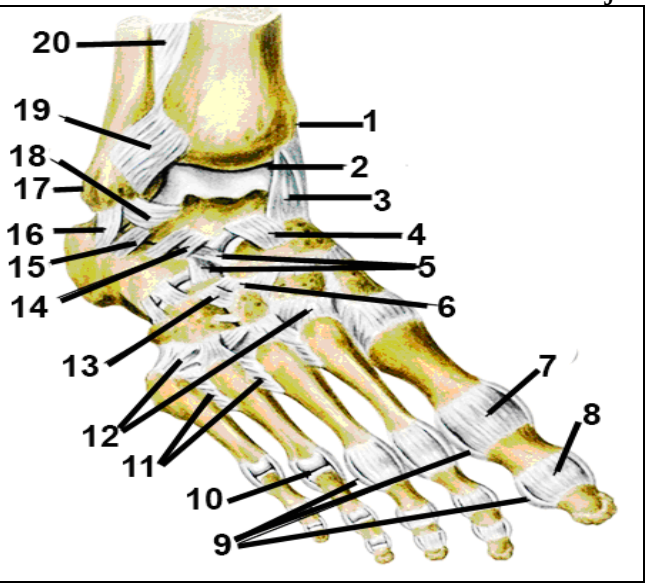


18. Which of the following statement(s) are/is correct about the ankle joint?
    1. It is a compaund joint.
    2. The joint is a hinge joint.
    3. Additional movements are possible with a plantar flexion.
    4. Movements around the vertical axis are possible.
    5. The main ligaments are located on the medial and lateral surfaces of the joint.

19. Which number indicates the anterior tibiofibular ligament in the figure?

20. Which number indicates the deltoid ligament in the figure?

21. Which number indicates the bifurcate ligament in the figure?



22. Which joint is/are Lisfranc's joint?
    1. Tarsometatarsal joints.
    2. Metatarsophalangeal joints.
    3. Interphalangeal joints.
    4. Cuneonavicular joint.
    5. Intermetatarsal joints.

23. Which ligament is the "key" of Lisfranc's joint?
    1. Lig. collaterale.
    2. Lig. plantare.
    3. Lig. cuneometatarsea interossea mediale.
    4. Lig. tarsometatarsea plantare.
    5. Lig. bifurcatum.

24. Which ligament is the "key" of Chopart's joint?
    1. Lig. calcanenaviculare plantare.
    2. Lig. talonaviculare.
    3. Lig. bifurcatum.
    4. Lig. deltoideum.
    5. Lig.talocalcaneum interosseum.
25. Which ligament(s) support(s) the longitudinal arch of the foot?
    1. Lig. bifurcatum.
    2. Lig. plantare longum.
    3. Ligg. tarsometatarsea dorsalia.
    4. Ligg. tarsometatarsea plantaria.
    5. Ligg. collateralia.

Situational tasks

1. A woman had a difficult childbirth because the newborn's weight was more than 5 kg. Now she feels pain in the pelvic area which was aggravated by dilating the iliac bones. A woman can not raise her lower limb. She can bend it without lifting her heel from the bed (a symptom of a “sticking heel”).

Do these symptoms indicate damage to the pelvis? What is your preliminary diagnosis? Does the woman need specialized care from a trauma specialist?

2. A 40-year-old man had been playing basketball and landed after a jump to his left lower limb. It was difficult to apply pressure on the injured leg. The insignificant restriction of the active and the passive movements, smoothness of the contours of the knee joint, external deviation of the leg in the left knee joint in comparison with the right one were detected. Radiological pathology was not detected.

What is your suspected diagnosis? What simple manipulation will help strengthen your assumption?

3. A 35-year-old man was delivered to the trauma center in 15 minutes after the traumatic amputation of the foot at the level of the distal row of the tarsal bones. The traumotologist desided to remove the crushed tissues and exarticulate (removal along the joint), followed by the suturing of the wound.

Which joint is more rational for exarticulation and which ligament should be dissected first? Why?

Memorize the following eponyms

Ligament of Bigelow (E. Bertin) - iliofemoral ligament, *lig. iliofemorale*, [syn. ligament of Bertin and any combinations of these names] is a ligament of the hip joint which extends from the ilium to the femur in front of the joint. It arises from the anterior inferior iliac spine and the rim of the acetabulum, the iliofemoral ligament spreads obliquely downwards and laterally to the intertrochanteric line on the anterior side of the femoral head. In a stand-

ing posture, when the pelvis is tilted posteriorly, the ligament is twisted and tense, which prevents the trunk from falling backwards and the posture is maintained without the need for muscular activity. In this position the ligament also keeps the femoral head pressed into the acetabulum. The iliofemoral ligament is stronger than the two other ligaments of the hip joint.

Bonnet joint (A. Bonnet) - cuneonavicular joint, *art.cuneonavicularis*.

Weber zone (ligament), zonular band (M.I. Weber), annular ligament, *zona orbicularis* is a ligament on the neck of the femur formed by the circular fibers of the articular capsule of the hip joint.

Weber point (W.E. Weber) - a point corresponding to the center of gravity human body. It is located 1 cm below the promontorium of the sacrum.

Deventer pelvis (N. Deventer) is a simple flat pelvis in which all direct sizes are reduced.

Assignment for students to assess the acquired knowledge of the class topic:

1. Show continuous (including symphysis) joints of the pelvic girdle.
2. Show the discontinuous joints of the pelvic girdle, give their general anatomical and functional characteristics.
3. Show the joints of the free lower limb give their general anatomical and functional characteristics.
4. Show the hip joint, form this joint, give its general anatomical and functional characteristics.
5. Show the knee joint, form this joint, give its general anatomical and functional characteristics.
6. Show the joints of the leg, form them, give their general anatomical and functional characteristics.
7. Show the ankle joint, form it, give its general anatomical and functional characteristics.
8. Show the joints of the foot, give their general anatomical and functional characteristic.
9. Show the clinical joints of the foot and ligaments, which are the keys of the joint.

References:

Main:

1. P. 159-175.
2. C. 214-242.
3. Рис. (fig.) 330-334,473-478,495-498,501,502 514,515.
4. P. 138-158.

Additional:

6. P. 12-13,18, 136-164.

Topic 12 Final control class on preparations of bones connection

Aim of the class: to determine the level of academic competencies (knowledge, skills) of students in the functional anatomy of joints, taking into account their importance for the clinic.

Motivational characteristics of the topic

Arthrology is the basic section for the study of all subsequent sections of anatomy and clinical disciplines, for work traumatologists, orthopedics, therapists, radiologists, etc.

Main issuess of the topic

The student names all the anatomical terms in Latin. Each student should be able to arrange each joint correctly in relation to himself/herself.

A student s hould demonstrate the knowledge of the following issues:

1. The structure of joints:

- the joints of the bones of the trunk (vertebral column, ribs, sternum),
- the joints of the upper limbs (pectoral girdle and free upper extremity),
- the joints of the lower limbs (pelvic girdle and free lower extremity),
- the joints of the skull.

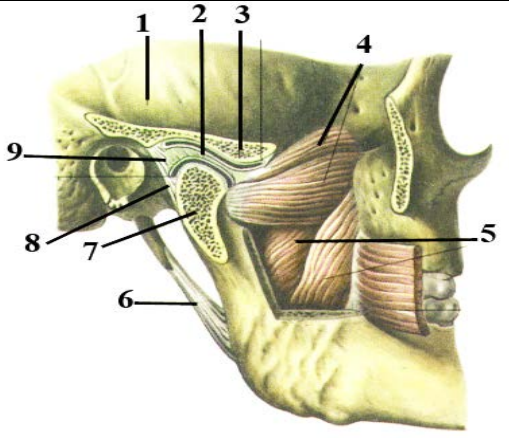
Information section and recommendations on unsupervised activites

1. Specific bone joins should be characterized according to the algorithm proposed in the recommendations in topic № 9, using the recommendations in topics №№ 9–11.

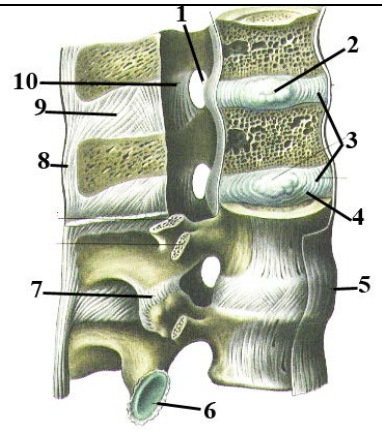
Visuals: a skeleton, a vertebral column, a skull, a skullcap, a base of the skull, preparations of all bones of the skeleton, museum preparations, the skull of a newborn, X-rays.

Test questions for self study and self-assessment or choice the right variant(s) of your answer:

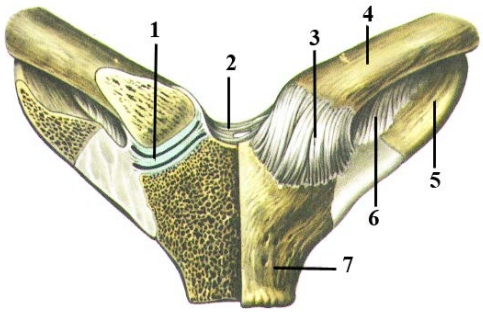
1. Which number indicates the stylomandibular ligament in the figure?
2. Which number indicates the articular disc in the figure?
3. Which number indicates the zygomatic process in the figure?



4. The greatest range of the motion is possible in the following joint:
   1. Shoulder joint.
   2. Elbow joint.
   3. Hip joint.
   4. Knee joint.
   5. Wrist joint.

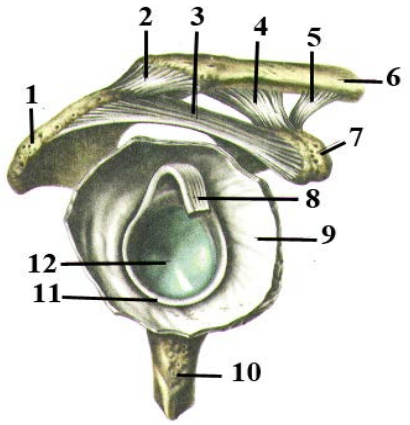
5. Which number indicates the ligament flava in the figure? 6. Which number indicates the nucleus pulposus of the intervertebral disc in the figure? 7. Which number indicates the zygapophysial joint in the figure?	

8. Which of the following joints is/are the plane joint(s)?
   1. Atlanto-occipital joint.
   2. Zygapophysial joints.
   3. Sternocostal joints.
   4. Knee joint.
   5. Elbow joint.
9. Which movements are possible at the temporomandibular joint?
   1. Lowering the lower jaw.
   2. Forward excursion.
   3. Lateral excursions.
   4. Medial excursions.
   5. Raising the lower jaw.

10. Which number indicates the costoclavicular ligament in the figure? 11. Which number indicates the anterior sternoclavicular ligament in the figure? 12. Which number indicates the articular disc in the figure?	

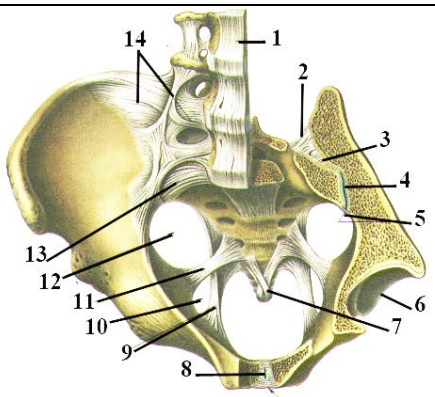
13. Which damage(s) is/are intra articular?
   1. Medial meniscus.
   2. Transverse ligament of knee.
   3. Alar folds.
   4. Fibular collateral ligament.
   5. Posterior cruciate ligament.

14. Which number indicates the trapezoid ligament in the figure?
15. Which number indicates the coraco-acromial ligament in the figure?
16. Which number indicates the acromioclavicular ligament in the figure?

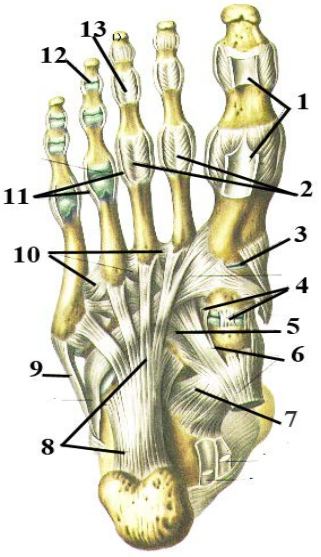


17. The pelvic outlet is limited by the following structures:
    1. Apex of the sacrum.
    2. Interpubic disc.
    3. Ramus of the ischium.
    4. Inferior pubic ramus.
    5. Sacrotuberous ligament.

18. Which number indicates the sacrospinous ligament in the figure?
19. Which number indicates the anterior sacrococcygeal ligament in the figure?
20. Which number indicates the interosseous sacro-iliac ligament in the figure?



21. Which number indicates the long plantar ligament in the figure?
22. Which number indicates the plantar metatarsal ligaments in the figure?
23. Which number indicates the collateral metatarsophalangeal ligaments in the figure?



24. Which of the following statements belong to the knee joint?
1. It is a bicondylar joint.
2. It is a compound joint.
3. It is a complex joint.
4. It is a combination joint.
5. It is the largest joint of the human body.

25. In which of the joint the number of axes of movement is atypical according of the shape of their articular surfaces?
1. Temporomandibular joint.
2. Lateral atlanto-axial joint.
3. Hip joint.
4. Sternoclavicular joint.
5. Joints of the heads of the ribs.

Situational tasks

1. A 14- year-old teenager fell from a bicycle on an outstretched hand. He was taken to the trauma center. He had pain onthe left shoulder joint and difficulty in the movements of his left limb. Examination detected the shortening of the shoulder girdle, a stepped distance of the external end of the clavicle and its displacement were revealed.

Which anatomical structures are damaged during this dislocation to be restored accordingly?

2. A 35-year-old man was a victim of a car accident. He complained of pain in the wrist. An ambulance doctor revealed the possibility of passive abduction and adduction movements in the wrist joint with a range of about 80^0.

Do these evidences indicate to the damage of the ligamentous apparatus of the joints? Is it possible to transport the victim without immobilization?

3. A 36-year-old man was a victim of a car accident. He complained of a pain in the elbow joint. An ambulance doctor revealed the range of the passive movement in the elbow joint is 190 degrees of the elbow flexion.

Do the evidences indicate the damage of the elbow joint? Is it possible to transport the victim without immobilization?

4. A 45-year-old woman complained of a pain in the region of the left knee joint. Hyperemia and swelling of the knee joint were found. The height of the articular cavity of the knee joint is 6 mm on the X-ray.

Is it the normal height of the articular cavity of the knee joint?

5. A 40-year-old man was hit by a log on the outer surface of the left knee joint. He felt a crunch and pain in the knee joint. He could not stand up whithout helping.The following symtoms were indicated: the bruises and pain on the outer surface of the knee joint, significant deviation of the left shin in comparison with the right shin. A fracture of the head of the left fibula was revealed on the X-ray.

Could this fracture be a reason of displacement of the shin inside? Is it intraarticular fracture? Explain, please.

A list of questions for final class on the preparations of connections between the bones

Block 1. Indicate in the anatomical specimens and bones; name in Latin term:

1. Sagittal axis, and the types of the movements around the given axis.
2. Frontal axis and the types of the movements around the given axis.
3. Vertical axis and the types of the movements around the given axis.
4. Longitudinal axis and the movements around the given axis.
5. Examples of the simple joints.
6. Examples of the compound joints.
7. Examples of the complex joints.
8. Examples of the combined joints.
9. Examples of the gomphoses.
10. Examples of the temporary synchondroses.
11. Examples of the permanent synchondroses.
12. Examples of the symphyses.
13. Examples of the hinge joints.
14. Examples of the cylindrical joints.
15. Examples of the ellipsoid joints.
16. Examples of the saddle joints.
17. Examples of the ball and socket joints.
18. Examples of the condylar joints.
19. Examples of the plane joints.
20. Examples of the uniaxial joints.
21. Examples of the biaxial joints.
22. Examples of the multiaxial joint.
23. Examples of the rotation (pronation and supination).
24. Examples of the circumduction.
25. Examples of opposition and reposition.
26. Examples of the amphiarthrosis.
27. Articular surfaces of the zygapophysial joint.
28. Articular surfaces of the temporomandibular joint.
29. Articular surfaces of the sacrococcygeal joint.
30. Articular surface of the atlanto-axial joint.
31. Articular surfaces of the median atlanto-axial joint.
32. Articular surfaces of the lateral atlanto-axial joint.
33. Articular surfaces of the joint of head of rib.
34. Articular surfaces of the costotransverse joint.

35. Articular surfaces of the sternocostal joint.
36. Articular surfaces of the sternoclavicular joint.
37. Articular surfaces of the acromioclavicular joint.
38. Articular surfaces of the shoulder joint.
39. Articular surface of the humeroradial joint.
40. Articular surface of the humero-ulnar joint.
41. Articular surfaces of the proximal radio-ulnar joint.
42. Articular surfaces of the distal radio-ulnar joint.
43. Articular surfaces of the wrist joint.
44. Articular surface of the midcarpal joint.
45. Articular surfaces of the carpometacarpal joints.
46. Articular surfaces of the metacarpophalangeal joints.
47. Articular surfaces of the interphalangeal joints of the hand.
48. Articular surfaces of the sacro-iliac joint.
49. Pubic symphysis.
50. Articular surfaces of the hip joint.
51. Articular surfaces of the knee joint.
52. Articular surfacesof the tibiofibular joint.
53. Articular surfaces of the ankle joint.
54. Articular surfaces of the subtalar joint.
55. Sagittal suture of the skull.
56. Coronal suture of the skull.
57. Lambdoid suture of the skull.
58. Articular disc of the temporomandibular joint.
59. Lateral ligament of the temporomandibular joint.
60. Sphenomandibular ligament of the temporomandibular joint.
61. Stylomandibular ligament of the temporomandibular joint.
62. Intervertebral disc.
63. Anterior longitudinal ligament.
64. Posterior longitudinal ligament.
65. Ligamenta flava.
66. Interspinous ligaments.
67. Supraspinous ligament.
68. Intertransverse ligaments.
69. Sacrococcygeal ligament.
70. Anterior atlanto-occipital membrane.
71. Posterior atlanto-occipital membrane.
72. Transverse ligament o fthe atlas.
73. Apical ligament of the dens.
74. Alar ligaments.
75. Cruciate ligament of the atlas.
76. Radiant ligament of head of the rib.

77. Costotransverse ligament.
78. Radiate sternocostal ligaments.
79. External intercostal membrane.
80. Internal intercostal membrane.
81. Anterior and posterior sternoclavicular ligaments.
82. Interclavicular ligament.
83. Costoclavicular ligament.
84. Acromioclavicular ligament.
85. Coracoclavicular ligament and its parts.
86. Coraco-acromial ligament.
87. Superior transverse scapular ligament.
88. Inferior transverse scapular ligament.
89. Glenoid labrum of the shoulder joint.
90. Coracohumeral ligament.
91. Ulnar collateral ligament of the elbow joint.
92. Radial collateral ligament of the elbow joint.
93. Annular ligament of the radius.
94. Oblique cord of the forearm.
95. Radial collateral ligament of the wrist.
96. Ulnar collateral ligament of the wrist.
97. Palmar radiocarpal ligament.
98. Dorsal radiocarpal ligament.
99. Radiate carpal ligament.
100. Pisometacarpal ligament.
101. Pisohamate ligament.
102. Dorsal carpometacarpal ligaments.
103. Palmar carpometacarpal ligaments.
104. Dorsal metacarpal ligament.
105. Palmar metacarpal ligaments.
106. Iinterosseous metacarpal ligament.
107. Transverse metacarpal ligament.
108. Anterior sacro-iliac ligament.
109. Posterior sacro-iliac ligament.
110. Interosseous sacro-iliac ligament.
111. Iliolumbar ligament.
112. Interpubic disc.
113. Superior pubic ligament.
114. Superior pubic ligament (Arcuate ligament of the pubis).
115. Sacrotuberous ligament.
116. Sacrospinous ligament.
117. Obturator membrane.
118. Greater sciatic foramen.

119. Lesser sciatic foramen.
120. Acetabular labrum.
121. Transverse acetabular ligament.
122. Zona orbicularis of the hip joint.
123. Iliofemoral ligament.
124. Pubofemoral ligament.
125. Ischiofemoral ligament .
126. Ligament of the head of the femur.
127. Lateral meniscus and medial meniscus of the knee joint.
128. Transverse ligament of the knee.
129. Fibular collateral ligament.
130. Tibial collateral ligament.
131. Oblique popliteal ligament.
132. Arcuate popliteal ligament.
133. Patellar ligament.
134. Medial patellar retinaculum and lateral patellar retinaculum.
135. Anterior cruciate ligament of the knee.
136. Posterior cruciate ligament of the knee.
137. Anterior ligament of the fibular head.
138. Interosseous membrane of the leg.
139. Posterior and anterior tibiofibular ligaments.
140. Anterior and posterior talofibular ligaments.
141. Calcaneofibular ligament.
142. Deltoid ligament of the foot.
143. Talocalcaneal ligaments.
144. Plantar calcaneonavicular ligament.
145. Talonavicular ligament.
146. Long plantar ligament.
147. Plantar calcaneocuboid ligament
148. Bifurcate ligament.
149. Cuneonavicular joint of the foot.
150. Dorsal and plantar tarsometatarsal ligaments.
151. Cuneometatarsal interosseous ligaments.
152. Dorsal and plantar metatarsal ligaments.
153. Deep transverse metatarsal ligament.
154. Interphalangeal joints of the foot.
155. Fontanelles of the skull.

Block 2. Describe and explain according to the algorithm

1. Classification of the joints.
2. Classification of the synovial joints (anatomical and biomechanical).

3. Features of the synovial joints.
4. Anatomical and functional characteristics of the temporomandibular joint.
5. Anatomical and functional characteristics of the zygapophysial joints.
6. Anatomical and functional characteristics of the sacrococcygeal joint.
7. Anatomical and functional characteristics of the atlanto-occipital joint.
8. Anatomical and functional characteristics of the median atlanto-axial joint.
9. Anatomical and functional characteristics of the lateral atlanto-axial joint.
10. Anatomical and functional characteristics of the joint of the rib head.
11. Anatomical and functional characteristics of the costotransverse joint.
12. Anatomical and functional characteristics of the sternocostal joints.
13. Anatomical and functional characteristics of the sternoclavicular joint.
14. Anatomical and functional characteristics of the acromioclavicular joint.
15. Anatomical and functional characteristics of the shoulder joint.
16. Anatomical and functional characteristics of the elbow joint.
17. Anatomical and functional characteristics of the distal radio-ulnar joint.
18. Anatomical and functional characteristics of the wrist joints.
19. Anatomical and functional characteristics of midcarpal joint.
20. Anatomical and functional characteristics of the carpometacarpal joints.
21. Anatomical and functional characteristics of the metacarpophalangeal joints.
22. Anatomical and functional characteristics of the interphalangeal joints of the hand.
23. Anatomical and functional characteristics of the sacro-iliac joint.
24. Anatomical and functional characteristics of the pubic symphysis.
25. Anatomical and functional characteristics of the hip joint.
26. Anatomical and functional characteristics of the knee joint.
27. Anatomical and functional characteristics of the tibiofibular joint.
28. Anatomical and functional characteristics of the ankle joints.
29. Anatomical and functional characteristics of the subtalar joint.
30. The structure of the joint, its main and accessory elements.
31. Development of the joints.
32. The structure of the joint in the X-ray image.
33. Vertebral column as a whole. Structural variation and anomalies.
34. Features of the upper limb as an organ of labour.
35. Features of the lower limb as an organ of support and motion.
36. Clinical joints of the foot.
37. Sizes of the greater pelvis and lesser pelvis.
38. The development of the upper limb in ontogenesis. Structural variation and anomalies.
39. The development of the lower limb in ontogenesis. Structural variation and anomalies.
40. The development of the axial skeleton in ontogenesis.

41. The pelvis as a whole. Structural variation and anomalies.
42. Thorax as a whole. Structural variation and anomalies.
43. Foot as a whole. The arches of the foot. The hard foundation of the foot. Active and passive structures that maintain the arches of the foot. Clinical aspects.
44. Development of skull in ontogenesis. Structural variation and anomalies.
45. The skull as a whole. Features of connections of the skull bones.
46. The hand as a whole. Features of connection of bones of the hand.
47. The greater pelvis and lesser pelvis. Apertures and openings of the pelvis.

References:

Main:

1. P. 129-175.
2. C. 166-242.
3. Рис. (fig.) 18-23,155-159,183,184,243,330-334,408, 422-425,439-445,473-478,495-498,501,502,514,515.
4. P. 97-172.

Additional:

5. P. 140-161, 196-214.
6. P. 136-164.
3. P. 3-43, 204-206.

Topic 13 Skeletal muscles: classification, structure, principles of their functioning. The muscles and fascia of the back

Aim of the class: to study the general structure of the skeletal muscles, the anatomy of the muscles, fascia of the back and their functional role.

Motivational characteristics of the topic

Skeletal muscles are an active part of the locomotion apparatus that provides form, support, stability, and movement of the body. So the knowledge of the features (peculiarities) of the muscular system is necessary when studying traumatology, surgery, neurology, sports medicine, physical therapy etc.

Main issues of the topic

1. Muscle as an organ. General data concerning the structure of muscles.
2. Classification of the muscles according their shape, topography,structure, origin, functions, development.
3. Muscles activity.
4. Muscles of the back, their classification:
   a) superficial muscles of the back;
   b) deep muscles of the back;
   c) suboccipital muscles.
5. Fascia of the back.

Information section and recommendations on unsupervised activites

1. The study of the anatomy of the skeletal muscles should begin with a study of the introductory lecture on myology and the introductory part of the section "Myology" in the textbook.
2. Muscles should be studied, using a cadavar, the museum samples of the muscular system (the museum of the locomotion apparatus), a relief model and tables describing the corresponding groups of the muscles. To study the functions of the skeletal muscles, to pay attention to the dependence of muscular movements, on its location related to the joint, directions of its muscular fibres, positions of the points of the origin and muscle attachment.
3. Modeling the movements to be performed in the contraction of each muscle on the skeleton, or on yourself (or your groupmate) by bringing the fixation points of the muscles closer. It should be memorized that the *fixed end* and the *mobile end* of each muscle can vary, depending on the conditions of the fixation of these points.
4. When studying the functional anatomy of the muscular system, attention should be paid to the muscle groups that perform a particular function. At the same time, muscle antagonists and synergists are distinguished. Antagonists are called muscles to perform the opposite movement. Synergists are muscles, during the contraction of which one movement is performed. It is necessary to realize that while performing various movements the same muscles can be synergists or antagonists according to the body position.
5. For the subsequent study of the section "Peripheral Nervous System" and the practical work of a physician learn to distinguish between truncipetal, truncifugal and autochthonous (proper) muscles. Truncipetal muscles develop from mesenchymal rudiments of the limbs and their proximal ends which move onto the body. Nerves grow into these muscles from the limbs. Truncifugal muscles develop from the ventral sections of myotomes. Their distal ends move from the body onto the bones of the extremites and the skull. Nerves grow into these muscles from the trunk. Autochthonous are the muscles that are laid and located on the body. They receive innervation from the nerves in the area of their location.
6. When studying the muscles of the back, learn their division into superficial and deep. Due to the location of the muscles of the back in the posterior cervical region (the nuchal region), it is more advisable to consider the posterior muscles of the neck from the group of the suboccipital muscles together with the muscles of the back.
7. When studying the function of all the muscles of the trunk and the head, one should distinguish between movements that can occur with unilateral or bilateral muscle contraction, because all of these muscles are paired. Under different conditions of contraction of these muscles, movements can be performed

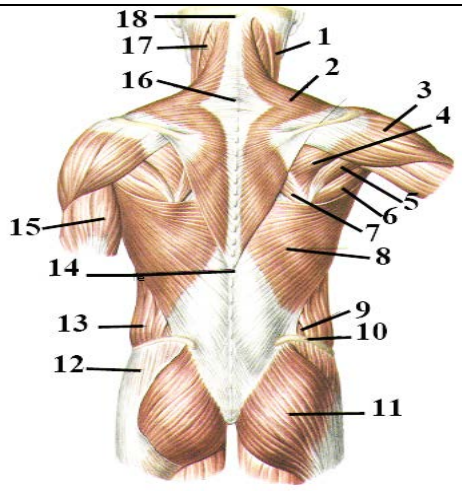
both in the direction of contracting muscles (in their direction), and in the direction opposite to the location of the contracted muscle.
8. When studying the superficial muscles of the back, remember that they have one fixation point on the bones of the upper limb – truncipetal muscles (except for the serratus posterior muscle). They should be studied in layers, for this purpose the muscles are conventionally divided into 3 layers. The outer layer is made up of the trapezius muscle and latissimus dorsi muscle, the middle one is a levator scapulae muscle, a rhomboid major muscle and a rhomboid minor muscle, and the inner one includes a serratus posterior superior muscle and a serratus posterior inferior muscle.
9. When studying the deep back muscles, consider that they are subdivided into 3 layers. The outer layer is composed of the splenius capitis, the splenius cervicis, and the erector spinae muscle. The middle layer includes the transversospinale muscle. The deepest layer is represented by the interspinales and intertransversarii muscles that are available just at the level of the most mobile parts of the vertebral column (cervical and lumbar). The deepest layer also includes the back muscles of the neck from the group of the suboccipital muscles to affect only the atlantooccipital and atlantoaxial joints.
10. When studing the erector spinae, learnthat the course of its fibres is oriented from the bottom of the sacrum upward and outward. In the region of the lumbar vertebre, it is divided into 3 tracts, each of which has the name of the corresponding muscle. The lateral tract is the iliocostalis, the middle one is the longissimus, and the medial tract is the spinalis. In each of the muscles, in its turn, there are 3sections that correspond to the section of the body.
11. When studying the transversospinales, pay attention to the fact that the course of its fibres is oriented from the bottom of the transverse proesses upwardand inward. Depending on the number of vertebrae through which they are thrown,they are subdivided into 3 muscles: the semispinalis muscle (the longest muscle and the most superficial of them), multifidus muscle (average in their length and location), rotatores muscle (the deepest and the shortest ones). In each of them, in its turn, there are 3 sections corresponding to the section of the body.
12. When studying the function of the deep muscles of the back, learn that with a bilateral reduction they are all synergists as they unbend the spine or its corresponding department. The upper ones move the head back. When the body is bent to the right or to the left, all muscles of the corresponding side are synergists.
13. When studying the suboccipital muscles, find the major rectus capitis posterior muscle, the minor rectus capitis posterior muscle, the superior oblique capitis muscle, and the inferior oblique capitis muscle. Keep in mind their functions.

14. When studying fascia of the back, find thoracolumbar fascia (superficial and deep laminae) and the nuchal fascia. Consider that between the laminae of the thoracolumbar fascia there is the erector spinae muscle and the deeper muscles to be enclosed in the osteofibrous sheaths.
15. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation № 1-14 of this block.

Visuals: a cadaver with the dissected muscles of the back, a human skeleton, a vertebral column, vertebrae, ribs, training models, relief models, tables.

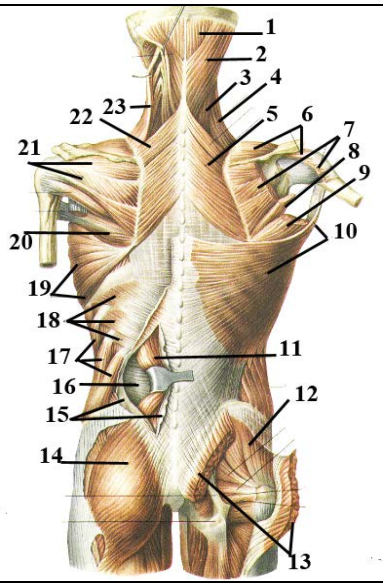
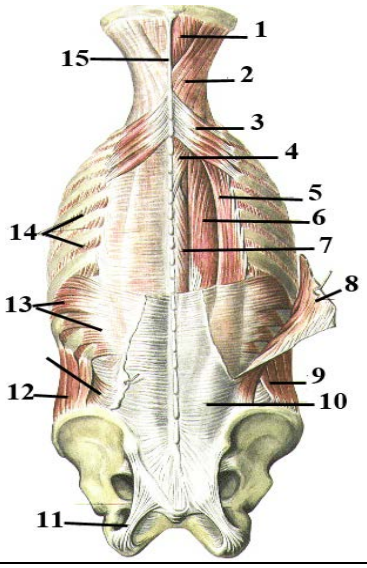
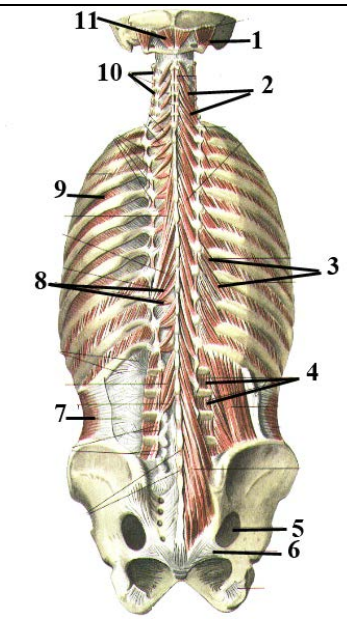
Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Which of the following muscles are the superficial muscles of the back?
   1.Trapezius muscle.
   2. Rhomboid major muscle.
   3. Serratus posterior inferior muscle.
   4. Erector spinae muscle.
   5. Levator scapulae muscle.

2. Which number indicates the trapezius muscle in the figure? 3. Which number indicates the splenius capitis muscle in the figure? 4. Which number indicates the latissimus dorsi muscle in the figure?	

5. Which of the following muscle of the back causes adduction of the arm to the body and pronation in the shoulder?
   1. Trapezius muscle.
   2. Latissimus dorsi muscle.
   3. Levator scapulae muscle.
   4. Rhomboid major muscle.
   5. Serratus posterior inferior muscle.

6. A person moves her/ his shoulder joint using the contraction of the following muscle(s):
   1. M. trapezius.
   2. M. levator scapulae.
   3. M. latissimus dorsi.
   4. Mm. rhomboidei major et minor.
   5. Mm. serratus posteriores superior et inferior.

7. Which number indicates the rhomboid minor muscle in the figure? 8. Which number indicates the serratus posterior inferior muscle in the figure? 9. Which number indicates the superficialis lamina of the thoracolumbar fascia in the figure?	
10. Which number indicates the longissimus muscle in the figure? 11. Which number indicates the serratus posterior superior muscle in the figure? 12. Which number indicates the iliocostalis muscle in the figure?	
13. Which number indicates the semispinalis muscles in the figure? 14. Which number indicates the intertransversarii laterales lumborum muscles in the figure? 15. Which number indicates the levatores costarum muscles in the figure?	

16. Denote the muscle(s) which turn(s) the head to the back side at the both-sided contraction.

1. Trapezius muscle.
2. Rectus capitis major et minor muscles.
3. Obliquus capitis superior muscle.
4. Semispinalis capitis muscle.
5. Latissimus dorsi muscle.

17. Which of the following muscles move the scapula towards the vertebral column?

1. M. trapezius.
2. M. levator scapulae.
3. Mm. rhomboidei major et minor.
4. M. latissimus dorsi.
5. M. serratus posterior.

18. Which muscle(s) has/have an attachment on the bones of the free part of the upper limb?

1. M. trapezius.
2. M. latissimus dorsi.
3. M. levator scapulae.
4. Mm. rhomboidei major et minor.
5. M. longissimus.

19. Indicate the parts of the erector spinae muscle.

1. M. iliocostalis.
2. M. longissimus.
3. M. spinalis.
4. M. splenius cervicis.
5. M. splenius capitis.

20. Which muscle(s) bend(s) the appropriate parts of the vertebral column to the corresponding side?

1. M. erector spinae.
2. M. latissimus dorsi.
3. M. iliocostalis.
4. M. transversospinalis.
5. Mm. rotatores.

21. Denote the muscles, which are antagonists of the multifidus muscles at the rotation of the body.

1. M. erector spinae.
2. M. latissimus dorsi.
3. M. iliocostalis.
4. Mm. semispinales.
5. Mm. rotatores.

22. Which muscles of the corresponding side are synergists of the semispinalis muscles?

1. M. longissimus.
2. M. latissimus dorsi.
3. M. iliocostalis.
4. Mm. multifidi.
5. Mm. rotatores.

23. Which muscles of the back are involved in the act of breathing?

1. M. spinalis thoracis.
2. Mm. rhomboidei major et minor.
3. M. trapezius.
4. Mm. serratus posterior superior et inferior.
5. M. semispinalis thoracis.

24. Which muscles are involved in the flexion of the head to the corresponding side?

1. M. splenius capitis.
2. M. trapezius.
3. M. rectus capitis minor.
4. Mm. Intertransversarii.
5. Mm. interspinales.

25. Which muscles are involved in the rotation of the head to the corresponding side?

1. M. splenius capitis.
2. M. trapezius.
3. M. rectus capitis major.
4. Mm. intertransversarii.
5. M. obliquus capitis inferior.

Situational tasks

1. A 19-year-old student felt pain in the occipital region after prolonged sitting at an open window. A neurologist diagnosed the inflammation of the posterior branches of the cervical spinal nerves on the left side of the neck. These nerves supply the suboccipital muscles and the deep muscles of the back.

Which movements could not perform the patient? Which muscles are involved in the movements?

2. A 40-year-old man came to the policlinic with complaints about difficulties in moving the right upper limb. A neurologist examined the activity of the muscles of the upper limb and diagnosed the inflammation of the thoracodorsal nerve which supplys the latissimus dorsi muscle.

Which movements could not perform the patient?

3. A 50-year-old man came to the policlinic with complaints about difficulties in moving the right shoulder girdle. A neurologist knew that several muscles

that get their innervation from different nerves are involved in performing these movements. A neurologist tested the possibility of performing all the movements by these muscles. During the examination he found out that the patient had the weakened functions of adduction of the right scapula to the vertebral colmn while raising it. No other violations have been found. Based on the examination, he diagnosed the patient with one of the nerves damage.

Which muscles do not work? What other muscles are involved in the adduction to the vertebral column and raising the scapula? Enumerate the movements to help to check it.

Memorize the following eponyms

Grynfeltt-Lesshaft (J.C.Grynfelt, P.F.Lesgaft**) rhombus** (space, triangle, fissure) the lumbar tendon gap, *spatium tendineum lumbale*, —the area of the posterior wall of the abdomen in the lumbar region, which is a point for the exit of the lumbar hernia. It is limited from above by the lower edge of the posterior lower serratus muscle, medially by the external edge of the erector spinae, laterally and from below by external and internal oblique muscles of the abdomen.

Petit triangle (J.L. Petit), *trigonum lumbale*, bounded below by the iliocostalis crest, medially by the edge of latissimus dorsi muscle, laterally by the external oblique muscle of abdomen, the bottom is formed by the internal oblique muscle of abdomen. It is the place of exit of the lower lumbar hernias, abscesses from the retroperitoneal space.

Rhombus of Michaelis (G.A. Michaelis) is a sacral rhombus, a recess in lumbosacral region, bounded above and outside by the junction of aponeurosis in the abdomen of latissimus dorsi muscle, below and outside by the edges of gluteus maximus muscle and iliac crests.

Assignment for students to assess the acquired knowledge of the class topic:

1. Classification of the skeletal muscles.
2. What are the characteristics of the skeletal muscle as an organ?
3. How are skeletal muscles classified according to the development, the direction of the fibres, the arrangement, the shape, the relation to the joints, the topography, the function, the quantity of the heads, the quantity of the belly? Give examples.
4. What structures compose the auxiliary apparatus of the muscles?
5. What are the principles of the work of the skeletal muscles?
6. Name and show the superficial muscles of the back on a cadaver, relief models and their places of the origin and insertion on the bones. Demonstrate the movements performed by each of the muscles.
7. Name and show the deep muscles of the back of the superficial layer on a cadaver, relief models, and their places of the origin and insertion on the bones. Demonstrate the movements performed by each muscle.

8. Name and show the deep muscles of the back of the middle layer on a cadaver, relief models and their places of the origi and insertion on the bones. Demonstrate the movements performed by each muscle.
9. Name and show the deep muscles of the back of the deep layer on a cadaver, relief models and their places of the origin, attachment on the bones. Demonstrate the movements performed by each muscle.
10. Name and show the suboccipital muscles on a cadaver, relief models and and their places of the origin, attachment on the bones. Demonstrate the movements peformed by each muscle.
11. Describe and show the fascia of the back on a cadaver, relief models.

References:

Main:
1. P. 175-199.
2. C. 244-274, 317-319.
3. Рис.(fig.) 171-177, 409.
4. P. 174-189.

Additional:
5. P. 59-65.
6. P. 341-343.
7. P. 77-85.

Topic 14 The muscles and fasciae of the thorax, abdomen and diaphragm. Rectus sheath. Inguinal canal

Aim of the class: to study the anatomy and function of the muscles and the fasciae of the thorax, abdomen, diaphragm. To study the structure of rectus sheath as well as of the walls and openings of the inguinal canal.

Motivational characteristics of the topic

The knowledge is necessary for surgeons, neurologists, traumatologists, therapists, pediatricians, physical therapy specialists, etc.

Main issues of the topic

1. Classification of the thoracic muscles.
2. Superficial muscles of thorax.
3. Deep muscles of thorax.
4. Diaphragm: parts, orifices, weak places, structural feature of the lumbar region.
5. Fascia of the thorax.
6. Muscles of the lateral abdominal wall.
7. Muscles of the anterior abdominal wall.
8. Muscles of the posterior abdominal.
9. Fasciae of the abdominal region.
10. Rectus sheath.
11. Inguinal canal.

Information section and recommendations on unsupervised activites

1. When studying the thoracic muscles, consider their division into superficial muscels and deep (proper) muscles.
2. When studying the superficial muscles of the thorax, find the pectoralis major muscle, the pectoralis minor muscle, the subclavius muscle and the serratus anterior muscle. When studying the deep muscles of the thorax, find the external and internal intercostal muscles, the subcostales muscle, the transversus thorac muscle and the levatores costarum muscles.
3. When studying the functional role of the superficial muscles of the thorax, it is necessary to keep in mind and simulate their movements in the following cases: 1) the mobile end is located on the bones of the superior limb; 2) the bones of the superior limb are fixed.
4. Consider that the deep muscles of the thorax act only on the ribs and participate in respiratory movements of the thorax. The external intercostal muscles and the levatores costarum muscles participate in the act of the inhalation. The internal intercostal muscles, the subcostales muscles, and the transversus thoracis are involved in the act of the exhalation.
5. When studying the diaphragm, find the following formations: its lumbar, costal and sternal parts, central tendon, right crus and left crus, medial, lateral and median arcuate ligaments. Indetify «weak» places of the diaphragm: the aortic hiatus, the oesophageal hiatus, the caval opening, the sternocostal and the lumbocostal triangles. It should be remembered that the diaphragm (apart from the right crus and the left crus) develops from the cervical myotomes.
6. When studying the fascia of the thorax, find the superficial, pectoral, thoracic and endothoracic fasciae. Consider the fact that there are superficial and deep subpectoral interfascial spaces to pass into the space of the axillary cavity.
7. Muscles of the abdomen are subdivided according to their location into the muscles of the lateral, anterior and posterior abdominal walls.
8. Find the following lateral muscles of the abdominal wall: the external and internal oblique muscles, the transversus abdominis muscle. Identify the anterior muscles of the abdominal wall (the rectus abdominis and the pyramidalis muscles) and posterior muscle of the abdominal wall (the quadratus lumborum muscle).
9. Take into account that the abdominal muscles have different important functions. They assist as muscles of exhalation in the breathing process at forceful exhalation. Moreover, these muscles serve as protection for the inner organs. Furthermore, together with the back muscles they provide postural support, important in defining the form. When the glottis is closed and the thorax and pelvis are fixed, they are integral in the cough, urination, defecation, childbirth, vomit. Due to the difference in their fixation points these muscles act differently on to multiaxial intervertebral joints, providing different body move-

ments. So flexing the body forward provides a two-way contraction of both oblique and rectus abdominis muscles. When the body is flexed to the side oblique and rectus muscles of the corresponding side contract. When the body rotates the internal oblique muscle from its side and external oblique muscle from the opposite side contract.

10. When studying the fascia of the abdomen one should imagine the location of the superficial abdominal fascia to find the proper fascia of abdomen and transversalis fascia.

11. To understand the interposition and functioning of the lateral muscles and rectus abdominal, it is necessary to consider the construction of the rectus sheath. For this purpose it should be made clear that three broad muscles of both sides of the abdomen in their front sections pass into wide tendons, aponeuroses. The latter grow together along the midabdomenal line into the linea alba located between the xiphoid process and the pubic symphysis. The structure of the walls of this shealth is not the same at different levels of the anterior abdominal wall. The rectus sheath is formed by the external oblique aponeurosis and the half of the internal oblique abdominal muscle aponeurosis in the upper and middle thirds the anterior wall. The rectus sheath is formed by the second half of the internal oblique aponeurosis and the transversus abdominis aponeurosis in the upper and middle thirds the posterior wall. The anterior wall of the rectus sheath is formed by the aponeuroses of all three lateral muscles below the umbilical ring. The transversalis fascia is theposterior wall of the rectus sheath below the umbilical ring.

12. When studying the anatomy of the inguinal canal, it should be kept in mind that the canal is the fissure between the inguinal ligament and the free lower borders of the internal oblique and transversus abdominis muscles covered in front by an aponeurosis of the external oblique abdominal muscle and behind by the transversalis fascia. Find the walls of the canal, its openings (superficial and deep inguinal rings), medial crus, lateral crus and intercrural fibers surrounding the superficial ring.

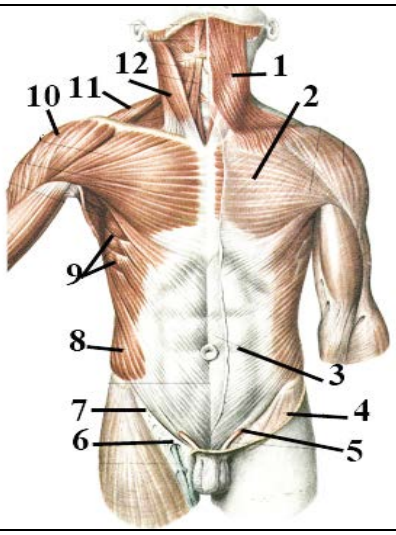
13. In order to understand the possibility of hernia formation (organs' output beyond the abdominal cavity), it is necessary to remember the location of the weak points of the abdominal wall. Find the umbilical ring in the linea alba, the inguinal canal, the lumbar triangle, as well as the folds and the fossae of the inner surface of the anterior abdominal wall (median, medial and lateral umbilical folds, supravesical, medial lateral inguinal fossae).

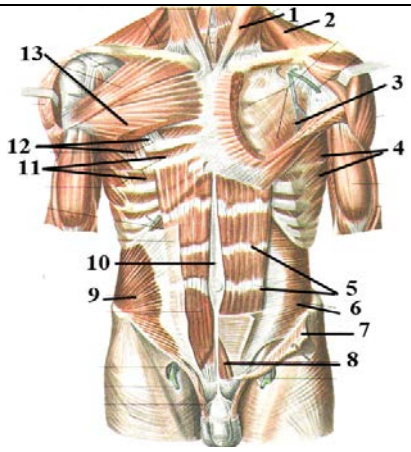
14. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation № 1-13 of this block.

Visuals: a demonstrational cadaver with dissected muscles of the trunk and the shoulder, human skeleton, the vertebral column, training models, relief models, tables.

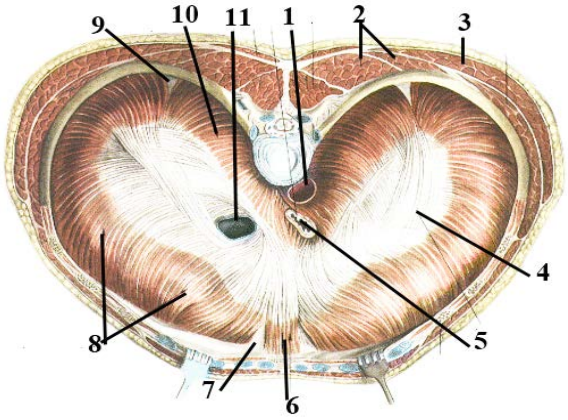
Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Denote the places of the origin and the insertion of the pectoralis major muscle?
   1. Clavicle.
   2. Sternum .
   3. Crest of the greater tubercle of the humerus.
   4. Crest of the lesser tubercle of the humerus.
   5. Deltoid tuberosity of the humerus.

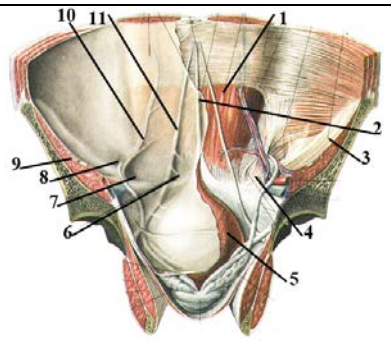
2. Which number indicates the pectoralis major muscle in the figure? 3. Which number indicates the serratus anterior muscle in the figure? 4. Which number indicates the inguinal ligament in the figure?	

5. Which number indicates the pectoralis minor muscle in the figure? 6. Which number indicates the internal oblique muscle in the figure? 7 Which number indicates the pyramidal muscle in the figure?	

8. Denote the places of the origin and the insertion of the pectoralis minor muscle?
   1. Clavicle.
   2. Coracoid process of the scapula.
   3. Sternum.
   4. Acromial process of the scapula.
   5. II-V ribs.
9. Which of the following muscles elevate the ribs?
   1. Pectoralis major muscle.
   2. Pectoralis minor muscle.
   3. Internal intercostal muscle.
   4. External intercostal muscle.
   5. Levatores costarum muscle.

10. Which number indicates the lumbar part of the diaphragm in the figure? 11. Which number indicates the oesophageal hiatus of the diaphragm in the figure? 12. Which number sternocostal triangle of the diaphragm in the figure?	

13. What walls are distinguished in the inguinal canal?
    1. Medial wall.
    2. Superior wall.
    3. Inferior wall.
    4. Anterior wall.
    5. Posterior wall.
14. Which of the following abdominal muscles turn the body to the right side?
    1. Right external oblique muscle.
    2. Left external oblique muscle.
    3. Right internal oblique muscle.
    4. Left internal oblique muscle.
    5. Transversus abdominis muscle.
15. Hernias from the abdominal cavity come out through the following formations:
    1. Fissure linea alba of the abdomen.
    2. Inguinal canal.
    3. Sternocostal triangle of the diaphragm.
    4. Lumbocostal triangle of the diaphragm.
    5. Umbilical ring.
16. What are the autochthonous muscles of the thorax?
    1. Mm. intercostales externi.
    2. Mm. intercostales interni.
    3. Mm. subcostales.
    4. M. transversus thoracis.
    5. Mm. intercostales intimi.
17. Which of the following structures take part in the formation of the posterior wall of the rectus sheath above the umbilical ring?
    1. Lig. inguinale.
    2. Aponeurosis m. obliquus internus abdominis.
    3. Aponeurosis m. obliquus externus abdominis.
    4. Aponeurosis m. transversus abdominis.
    5. Fascia transversalis.

18. Which number indicates the deep inguinal ring in the figure? 19. Which number indicates the lateral umbilical fold in the figure? 20. Which number indicates the medial inguinal fossa in the figure?	

21. The deep inguinal ring on the posterior surface of the anterior abdominal wall is located within the following structure:
    1. Fossa inguinalis medialis.
    2. Fossa supravesicalis.
    3. Lacuna vasorum.
    4. Fossa inguinalis lateralis.
    5. Lacuna musculorum.
22. What is/are the superficial inguinal ring limited by?
    1. Crus laterale.
    2. Crus mediale.
    3. Fibrae intercrurales.
    4. Lig. reflexum.
    5. Lig. lacunare.
23. The following structures take part in the formation of the walls of the abdominal cavity:
    1. Transversus abdominis muscle.
    2. Quadratus lumborum muscle.
    3. Internal intercostal muscle.
    4. Rectus abdominis muscle.
    5. Internal oblique muscle.
24. Which of the following muscles do not take part in the act of breathing?
    1. External intercostal muscles.
    2. Transversus thoracis muscles.
    3. Subcostales muscles.
    4. Rhomboid major muscles.
    5. Serratus posterior muscles.
25. Which of the following statement(s) is (are) incorrect about the linea alba?
    1. It contains few blood vessels and nerve receptors.
    2. It is formed by aponephrosis of two broad abdominal muscles.
    3. It has a width of 1,5-2 cm at the top.
    4. It has a width 4-5 cm near the umbilical ring.
    5. Sometimes hernias of the linea alba are formed.

Situational tasks

1. People having cardiac deficiency experience a respiratory failure with a respiratory obstruction.

Why does a person try to fix the shoulder girdle during the spasm?

2. A 17-year-old man has been examined on the lower part of the anterior abdominal wall to the left above the inguinal ligament. A doctor found a swelling 3.0 x 3.0 cm in size of a soft-elastic consistency. The bulges in the groin area were more prominent when coughing, straining, or standing up.

Which pathology do you suggest?

3. A 3-month-old baby was brought to the surgeon because of a swelling in the umbilical region. The examination of the umbilical region revealed a protrusion measuring 2.0 x 2.0 cm of soft-elastic consistency increasing when the baby was crying. When the baby was lying calm, the protrusion disappeared. A round umbilical ring 1 cm in diameter was palpated.

Which pathology do you suggest?

4. A 45-year-old woman came to the surgeon complaining about a swelling of the anterior abdominal wall that appeared after work in the kitchen garden. Examination showed a protrusion 3x4 cm in size of a soft-celastic consistency located in the midline of the abdomen 3 cm above the umbilical ring.

Which pathology do you suggest??

5. *Explain the reason why therapeutic exercises are prescribed in prenatal clinics to all pregnant women?*

Memorize the following eponyms

Bochdalek's foramen (fissure) (V.A. Bochdalek), lumbocostal triangle, *trigonum lumbocostale* is an area of the diaphragm at the border of its lumbar and costal parts that does not contain muscle fibers. It is the weak point of the diaphragm, the site of the formation of diaphragmatic hernia (usually on the left).

Larrhey's triangle (slit) (D.J. Larrey), sternocostal triangle, *trigonum sternocostale* is an area of the diaphragm on the border of its sternum and costal parts that does not contain muscle fibers. It is a weak spot of the diaphragm, the site of formation of the diaphragmatic hernia.

Poupart's ligament (F. Poupart), inguinal ligament, *ligamentum inguinale* is the lower edge of the aponeurosis of the external oblique muscle of the abdomen, tucked back and looking like a gutter. The ligament is stretched between the superior anterior iliac spine and the pubic tubercle.

Assignment for students to assess the acquired knowledge of the class topic:

1. Name and show the superficial muscles of the thorax on a cadaver and relief models, find the points of their origin and insertion on the bones. Demonstrate the movements to be performed by each muscle.

2. Name and show the deep thoracic muscles on a cadaver, relief models. Find the points of their origin and insertion on the bones. Demonstrate the movements to be performed by each muscle.
3. Name and show the parts, central tendon, layers of the diaphragm. Where do the muscular bunches of each part begin and end?
4. Show the openings of the diaphragm, specify their localization. What anatomical structures pass through them? Show the sternocostal triangle and lumbocostal triangle.Why may the diaphragm hernias be formed within these triangles?
5. Describe and show the topography of the pectoral fascia on a cadaver, relief models.
6. Name and show the muscles of the abdominal press and the posterior abdominal muscles on a cadaver, relief models. Find the points of their origin and insertion on the bones. Demonstrate the movements to be performed by each muscle.
7. Draw a layer-by- layer structure of the rectus sheath at different levels. Show its walls on a cadaver. What are the functions of the rectus sheath?
8. Characterize and show the topography of the fasciae of the abdomen on a cadaver, relief models.
9. Show the linea alba on ae cadaver and relief models. What are the linea alba formed by? What is the clinic significance of the linea alba?
10. Show the umbilical folds and the inguinal fossae on the inner surface of the anterior abdominal wall. What is the umbilical ring?
11. Show the inguinal canal on a cadaver, relief models and museum samples. What is its clinic significance? What are the walls of the inguinal canal formed? Specify the direction of the inguinal canal, its length and contents (in men, in women). What are the deep and superficial inguinal rings?

References:

Main:

1. P. 199-217.
2. C. 274-308.
3. Рис.(fig.) 185-188,191,192,245-258,409-413.
4. P. 190-206.

Additional:

5. P. 42-45,108,193-195.
6. P. 185,188,189, 202-218.

Topic 15 Muscles and fasciae of the head (facial muscles, masticatory muscles). Muscles and fasciae of the neck. Regions and triangles of the neck

Aim of the class: to study anatomy and functions of the muscles and the fasciae of the head and the neck, the features of their structure and functional

purpose, the anatomy of the interfascial spaces and the topographic formations of the neck.

Motivational characteristics of the topic

Knowledge concerning morphology of the head and neck muscles and the fascias are necessary for studying of the vessels and the nerves of this zone as well for clinic disciplines topographic anatomy, face surgery, plastic surgery, traumatology, neurology, etc.

Main issues of the topic

1. Muscles of the head:
   a) muscle of the facial expression,
   b) masticatory muscle.
2. Regions of neck, their borders.
3. Muscles of the neck:
   a) superficial muscles,
   b) suprahyoid muscles,
   c) infrahyoid muscles
   d) deep muscles.
4. Fasciae and interfascial spaces of the neck.
5. Triangles and spaces of the neck, their clinical significance.

Information section and recommendations on unsupervised activites

1. When studying the muscles of the head consider their division into the muscles of facial expression (mimic) and the masticatory muscles. In addition to this extra-ocular muscles, the muscles of the auditory ossicles, the muscles of the soft palate, the muscles of the tongue, the muscles of the pharynx consist of the striped muscle tissue.
2. When studying the muscles of facial expression, one should remember that they: a) have no fascia; b) are attached to the skin of the face and therefore, provide facial expressions; c) are divided into muscles of the calvaria and the muscles located around the natural openings of the head (around the circumference and radially respectively performing the function of compressors [sphincters] and expanders [dilators] of these openings.
3. When studying the muscles calvaria, find the epicranius muscle and its parts (the occipitofrontalis muscle, epicranial aponeurosis and rudimentary for humans temporoparietal muscle) as well as the procerus. Memorize that the epicranial aponeurosis is tightly fused with the skin and softly fused with the periosteum of the cranium. From the first letters of the English terms of the layers of the head comes the term “SCALP”. The scalp is usually described as having five layers, which can conveniently be remembered as a mnemonic: S: The skin on the head from which head hair grows. It contains numerous seba-

ceous glands and hair follicles. C: Connective tissue. A dense subcutaneous layer of fat and fibrous tissue that lies beneath the skin, containing the nerves and vessels of the scalp.A: The aponeurosis called epicranial aponeurosis (or galea aponeurotica) is the next layer. It is a tough layer of dense fibrous tissue which runs from the frontalis muscle anteriorly to the occipitalis posteriorly. L: The loose areolar connective tissue layer provides an easy plane of separation between the upper three layers and the pericranium. The medical concept of “scalp wound” is connected to the term.

4. When studying the muscles surrounding the palpebral fissure, find the orbicularis oculi muscle and its 3 parts (palpebral part, orbital part, lacrimal part) as well as the corrugator supercilii muscle.

5. When studying the muscles surrounding the nostrils, find the nasalis muscle and the depressor septi nasi muscle.

6. When studying the muscles surrounding the oral fissure find the orbicularis oris muscle, depressor anguli oris muscle and levator anguli oris muscle, depressor labii inferioris muscle, levator labii superioris muscle and levator labii superioris muscle, mentalis muscle, buccinator muscle, zygomaticus minor and zygomaticus major muscles, risorius muscle.

7. When studying the muscles of the auricular conha, consider that the anterior, posterior and superior auricularis muscles are rudimentary for humans. Together with the temporoparietalis part of epicranius muscle they can move the auricle in the corresponding direction.

8. When studying the masticatory muscles, consider that they arise from the mandible and provide its movements in the temporomandibular joint (except lowering). Find the masseter, the temporal muscle, the medial lateral pterygoid muscle and the lateral pterygoid muscle.

9. When studying fascia of the head, find the temporal fascia, the masseteric fascia, the buccopharyngeal fascia and the parotid fascia.

10. When studying the muscles of the neck take into consideration their division into the superficial muscles, the deep muscles and the neck muscles with origin or insertion on the hyoid bone (suprahyoid muscles and infrahyiod muscles).

11. Find the following superficial muscles: the platysma and sternocleidomastoid muscles, suprahyoid muscles (digastric, stylohyoid, mylohyoid and geniohyoid muscles), infrahyoid muscles (omohyoid, sternohyoid, sternothyroid and thyrohyoid muscles). Find the following deep muscles: the lateral group of the muscles (scalenus anterior, scalenus medius and scalenus posterior muscles) and the prevertebral group (longus colli, longus capitis, rectus capitis anterior, rectus capitis lateralis muscles).

12. When studying the topography of the neck, consider that two regions are distinguished in it. The posterior region is limited from a horizontal line connecting the upper edges of acromions of both scapulas through the spinalis process of the 7th cervical vertebra. Inferiorly it is limited by the highest nu-

chal line, laterally by the lateral edge of the trapezius muscle. The anterior region is limited by the base of the mandible (lower jaw) to the temporomandibular joint, inferiorly it is the suprasternal notch of the sternum and upper edges of the clavicles, and posteriorly it is the lateral edge of trapezius. The anterior region is subdivided into three regions: lateral, sternocleidomastoid and i anterior cervical regions.

13. When studying the neck regions, find the triangles and the markers that bound them. Find the omoclavicular and the omotrapezoidal triangles in the lateral region; the carotid triangle, the omotracheal triangle, the submental triangle, the submandibular triangle in the anterior region; the lingual triangle (Pirogov's) within the submandibular triangle.

14. When studying the location of the fascia of the neck, consider that there are several options for describing the fascia of the neck. According to the international anatomical terminology (1998), there is a cervical fascia, *fascia cervicalis*, consisting of three layers: superficial, pretracheal, and prevertebral.

15. To understand the clinical significance of the fascia of the neck, one should find the places of their attachment and their location.

16. To understand the pathways of inflammatory processes in the neck, it is necessary to find the location of interfascial spaces: suprasternal, pre- and retrovisceral (retropharyngeal).

17. To find the subclavian arteries and veins in the neck region, it is necessary to find the pre- and interscalenus spaces.

18. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation № 1-17 of this block.

Visuals: a demonstrational cadaver with the prepared muscles of the head and the neck, a human skeleton, a vertebral column, a skull, a mandibula, a hyoid bone, relief models, imitations, tables.

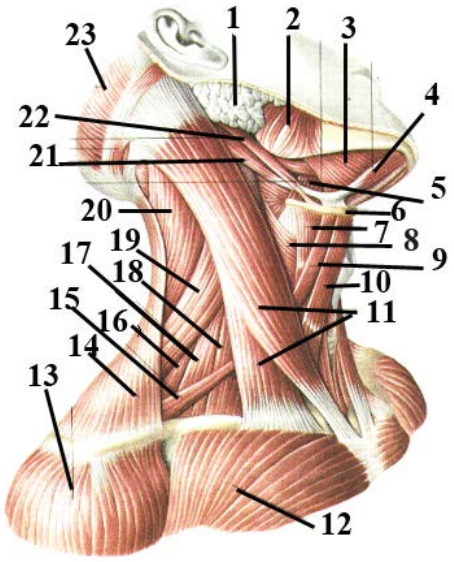
Test questions for self study and self-assessment or choice the right variant(s) of your answer:

1. Which of the following muscles are attached to the ribs?
    1. M. scalenus medius.
    2. M. serratus posterior superior.
    3. M. serratus posterior inferior.
    4. M. longus colli.
    5. M. rhomboideus major.
2. Which of the following muscles are the deep muscles of the neck?
    1. M. sternocleidomastoideus.
    2. M. digastricus.
    3. Mm. scaleni.
    4. Mm. longus colli et capitis.
    5. M. stylohyoideus.

3. Which number indicates the masseter in the figure?

4. Which number indicates the digastric muscle in the figure?

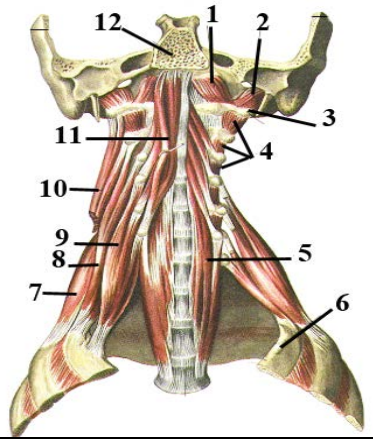
5. Which numbers indicate the scalenus muscles in the figure?



6. Which number indicates the longus colli muscle ?

7. Which number indicates the scalenus posterior muscle in the figure?

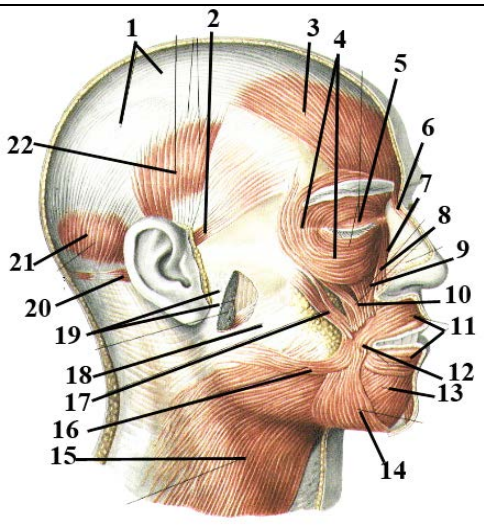
8. Which number indicates the rectus capitis lateralis muscle in the figure?



9. Which number indicates the zygomaticus major muscle in the figure?

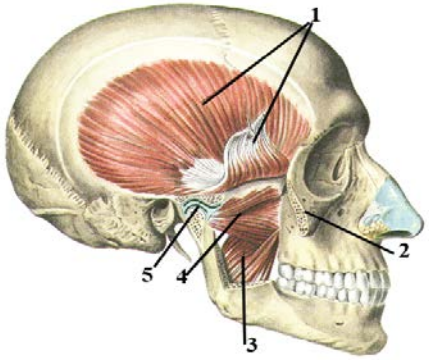
10. Which number indicates the levator labii superioris muscle in the figure?

11. Which number indicates the occipital belly of the occipitofrontalis muscle in the figure?



12. Which of the following muscles surround the oral fissure?
    1. M. orbicularis oris.
    2. M. levator labii superioris.
    3. M. buccinators.
    4. M. depressor labii inferioris.
    5. M. masseter.

13. Which of the following muscles pull the hyoid bone down?
    1. M. omohyoideus.
    2. M. stylohyoideus.
    3. M. genihyoideus.
    4. M. sternohyoideus.
    5. M. sternothyroideus.
14. Which of the following muscles bend head forward?
    1. M. sternocleidomastoideus.
    2. Platysma.
    3. M. scalenus medius.
    4. M. longus colli.
    5. M. rectus capitis anterior.
15. The angle of the mouth is turned down by the paralysis of the following muscle:
    1. M. levator anguli oris.
    2. M. levator labii superioris.
    3. M. buccinators.
    4. M. zygomaticus major.
    5. M. masseter.
16. Which of the following muscles limit the carotid triangle?
    1. M. sternocleidomastoideus.
    2. M. digastricus, venter posterior.
    3. M. digastricus, venter anterior.
    4. M. omohyoideus.
    5. M. mylohyoideus.
17. Where is the lingual triangle (Pirogov's) located?
    1. Trigonum caroticum.
    2. Trigonum omotracheale.
    3. Trigonum submandibulare.
    4. Trigonum submentale.
    5. Trigonum omotrapezoideum.

18. Which number indicates the temporal muscle in the figure? 19. Which number indicates the lateral pterygoid muscle in the figure? 20. Which number indicates the medial pterygoid muscle in the figure?	

21. Which of the following muscles are the antagonists of the orbicularis oris muscle?
1. Depressor anguli oris muscle.
2. Buccinator muscle.
3. Mentalis muscle.
4. Levator labii superioris muscle
5. Zygomaticus major muscle.

22. Which of the following muscles perform the lift of the mandible (lower jaw) in the temporomandibular joint?
1. Mm. digasrici.
2. Mm. pterygoideus lateralis.
3. Mm. mylohyoidei.
4. Mm. temporales, mm.masseter, mm. pterygoidei mediales.
5. Mm. geniohyoidei.

23. Which of the following muscles perform the movement of the mandible (lower jaw) forward?
1. M. masseter.
2. M. pterygoideus lateralis.
3. M. temporalis.
4. M. geniohyoideus.
5. M. pterygoideus medialis.

24. Prescalenus space is located between the following muscles:
1. M. omohyoideus et m. scalenus anterior.
2. M. sternohyoideus et m. scalenus posterior.
3. M. sternothyroideus et m. scalenus anterior.
4. M. scalenus anterior et m. scalenus medius.
5. M. scalenus medius et m. longus colli.

25. Which of the following interfascial spaces of the neck are not closed and communicate with the mediastinum?
1. Spatium antescalenum.
2. Spatium interscalenum.
3. Spatium supersternale.
4. Spatium previscerale.
5. Spatium retroviscerale.

Situational tasks

1. A 54-year-old man was delivered to the trauma center for help from the accident site. A wound was revealed in the region of the left zygomatic arch. The left eye was constantly open (it will not close), the wrinkles of the left half of the forehead are smoothed. The doctor diagnosed a partial damage to the temporal and zygomatic branches of the left facial nerve, which nerve supplys the muscles of the facial expression on the left side of the face.

Which muscles are paralysed?

2. *Remind a mimic muscle which images of the angry facial expression.*
3. A young man came to the clinic. During the examination at the theater institute he could not show a sad face. On examination, an almost imperceptible scar was revealed above the edge of the lower jaw backwards on the level of the left corner of the mouth. The doctor concluded that the upper part of the marginal branch of the lower jaw of the left facial nerve innervating the facial muscles had been damaged.

Why did the doctor make such a conclusion?

4. A 34-year-old man was examined by a neurologist who had a skull base fracture a year ago. Based on the examination the doctor revealed paralysis of the masticatory muscles on the left side to have been developed as a result of adamage of a part of the mandibular nerve.

Why did the doctor make the conclusion?

5. A 36-year-old man was brought to the district hospital with complaints of high temperature, pain in the throat and difficulty in swallowing that appeared 3 days ago when fishing. On examination a "neglected" pharyngeal abscess (purulent inflammation behind the pharynx) was revealed. The abscess was tapped but after the operation the patient still has a high temperature and pains in the thoracic part of the vertebral column.

Where and why did the purulent inflammatory process spread from the pharyngeal space?

Memorize the following eponyms

Pirogov's triangle (N.I. Pirogov) is a lingual triangle, *trigonum linguale.* It is restricted from below and in front by the posterior margin of the mylohyoid muscles, from below and behind by the tendon of the digastric muscles, from above by the hypoglossal nerve . It is a ligation site for lingual artery.

Richet (L.A. Richet) **velum** (aponeurosis, pretracheal layer), *lamina pretrachealis.* It is the pretracheal layer of the cervical fascia. The fascia is attached to the hyoid bone, the posterior surfaces of the clavicle and the manubrium of the sternum. The lateral border of this layer is the outer edge of the omohyoid. The pretracheal layer of the cervical fascia has the shape of a trapezoid, stands out in the middle section of the neck and forms fascial sheaths for the infrahyoid muscles.

Assignment for students to assess the acquired knowledge of the class topic:

1. What are the distinguishing features of the muscles of the facial expression? Name and show the muscles of the facial expression on a cadaver, relief models and show the points of their origin on the bones. Demonstrate the movements to be performed by each muscle during contractions.
2. Name and show the masticatory muscles on a cadaver, relief models, training models, and show the points of their origin and insertion on the bones.

Demonstrate the movements to be performed by each of the muscles during contractions.
3. Describe and show the topography of the fascia of the head on a cadaver, relief models.
4. Name and show the superficial muscles of the neck on a cadaver, relief models and show the points of their their origin and insertion on the bones. Demonstrate the movements to be performed by each of the muscles during contractions.
5. Name and show suprahyoid and infrahyiod muscles on a cadaver, relief models, and show the points of their their origin and insertion on the bones. Demonstrate the movements to be performed by each of the muscles during contractions.
6. Name and show the deep muscles of the neck on a cadaver, relief models and find the points of their their origin and insertion on the bones. Demonstrate the movements to be performed by each muscle during contractions.
7. What anatomical regions of the neck are distinguished? Name and show the neck triangles on a cadaver, training models. What is their clinical significance?
8. How is the fascia of the neck classified? Describe and show the topography of fascia of the neck on a cadaver, relief models.
9. What interfascial spaces of the neck are distinguished? Name and show the interfascial spaces of the neck and their borders on a cadaver, relief models. What is their clinical significance?

References:

Main:
1. P. 217-241.
2. C. 308-339.
3. Рис.(fig.) 25-30,48,49,58,59.
4. P. 207-223.

Additional:
7. P. 6,8,11,16-17,50-56,66-75.

Topic 16 Muscles, fascia, thopography of upper limb

Aim of the class: to study the anatomy and the function of the muscles and the fasciae of the upper limb, the thopographic formations of the upper limb.

Motivational characteristics of the topic

The muscles of the upper limb ensure its functioning as a body of labour. The knowledge of their functional anatomy is vital for the work of traumatologists, orthopedists, surgeons, neurologists, physiotherapy specialists, etc.

The main issues of the topic

A student should demonstrate the knowledge of following issues:

1. Muscles of the shoulder girdle.
2. Muscles of the arm.
3. Fasciae of the shoulder girdle and the arm.
4. Muscles of the forearm.
5. Muscles of he hand.
6. Fasciae of the forearm and the hand.
7. Axillary fossa and axillary cavity.
8. Radial canal (humeromuscular canal) and grooves of the arm.
9. Cubital fossa and grooves of the forearm.
10. Carpal tunnels.
11. Carpal tendinous sheaths.

Information section and recommendations on unsupervised activites

1. When studying the muscles of the upper limb, consider their division according to the parts of the skeleton of the upper limb: the muscles of the shoulder girdle, arm, forearm and hand.
2. When studying the function of the muscles of the upper limb, it should be taken into account that the muscles can be divided into groups according to their association with joints.They can bear influence upon judt one joint (monoarticular) or two or more joits (biarticular and multiarticular).
3. Find the following muscles of the shoulder girdle: the deltoid muscle, supraspinatus muscle, infraspinatus muscle, teres major and minor muscles, subscapularis muscle. Remember that, depending on the function, this group includes the muscles of the trunk: the pectoralis major and latissimus dorsi.
4. When studying the muscles of the arm, consider their division into two groups: the anterior muscles of the arm (coracorachial muscle, brachial muscle and biceps brachii muscle) and the posterior muscles of the arm (the triceps brachii muscle and anconeus muscle). Identify their origin and insertion.
5. When studying the muscles of the forearm, one should take into account their division into two groups: the anterior and posterior muscles of the forearm. There are four layers in the anterior group of the forearm. The first layer includs the brachioradialis muscle, pronator teres muscle, flexor carpi radialis muscle, flexor carpi ulnaris muscle, palmaris longus muscle. The second layer is formed by the flexor digitorum superficialis muscle. The third layer consists of the flexor digitorum profundus muscle and flexor pollicis longus muscle and the fourth layer is the pronator quadratus muscle. Find all of them. Find two layers in the posterior group of the forearm. The first layer is the extensor carpi radialis longus and extensor carpi radialis brevis muscles, extensor digitorum muscle and the extensor carpi ulnaris muscles. The second layer is the

abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor indicis, and supinator muscles.

6. When studying the muscles of the hand, consider that they are located only on the palmar surface of the hand and they are subdivided into 3 groups. Find the following groups and muscles: the muscles of the thenar eminence (abductor pollicis brevis, flexor pollicis brevis, opponens pollicis, adductor pollicis), the muscles of the hypothenar (palmaris brevis, abductor digiti minimi, flexor digiti minimi brevis, opponens digiti minimi) and the muscles of the middle group (lumbricals, dorsal interossei, palmar interossei muscles).

7. Consider that the same muscles of the upper limbs when performing different movements can be both synergists and antagonists.

8. When studying fasciae of the upper limb, find the following formations: the deltoid fascia, axillary fascia, brachial fascia, its medial and lateral intermuscular septums of the arm, antebrachial fascia, dorsal fascia of hand, extensor retinaculum, palmar aponeurosis, flexor retinaculum.

9. Find the axillary fossa, its edges, four walls, upper and lower apertures, three triangles on the anterior wall (clavipectoral, subpectoral, pectoral triangles), the trilateral and quadrilateral openings on the posterior wall.

10. Find the medial and lateral bicipital grooves, radial canal (humeromuscular canal), and cubital fossa, radial, median and ulnar grooves.

11. Find the following formations under the flexor retinaculum: two fascial septa and three osteo-fibrous canals or tunnels (lateral or radiall, carpal canal, medial or ulnar). Identify the synovial vaginae (tendon sheaths), arteries, veins, nerves in the canals of the hand.

12. Find the following formations under the extensor retinaculum: five septa and six osteo-fibrous canals or tunnels and the synovial vaginae (tendon sheaths) of the hand and their contents.

13. Find the hand fasciae, palmar aponeurosis, list and show the fibrous sheaths of digits of hand.

14. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation No. 1-13 of this block.

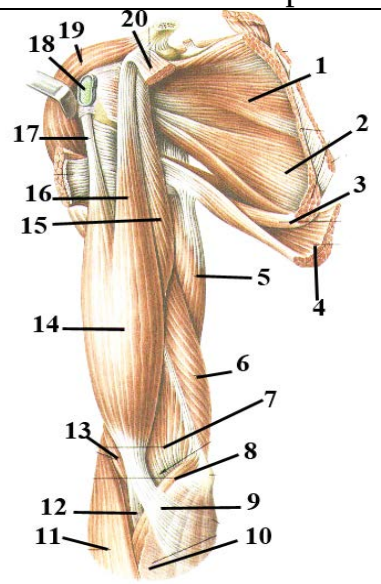
Visuals: a cadaver with the muscles of the trunk and the upper limb, a human skeleton, bones of the upper limb, relief models.

Test questions for self study and self-assessment or choice the right variant(s) of your answer:

1. Which of the following muscles supinate the shoulder joint?
    1. Teres major muscle.
    2. Teres minor muscle.
    3. Supraspinatus muscle.
    4. Infraspinatus muscle.
    5. Subscapularis muscle.

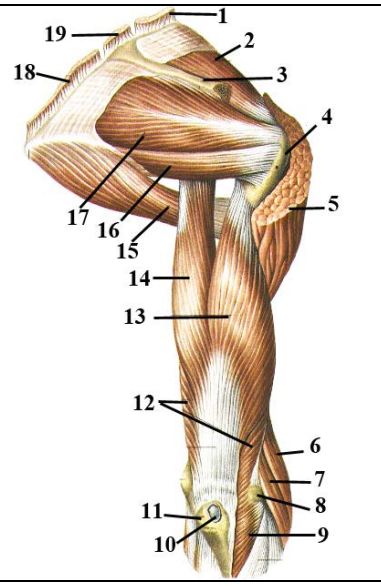
2. Where is (are) the origin(s) of the biceps brachii?

1. Coracoid process and supraglenoid tubercle of the scapula.
2. The medial epicondyle of the humerus and supraglenoid tubercle of the scapula.
3. Greater tubercle of the humerus and coracoid process of the scapula.
4. Infraglenoid tubercle of the scapula and lesser tubercle of the humerus.
5. Supraglenoid tubercle and infraglenoid tubercle of the scapula.

3. Which number indicates the deltoid muscle in the figure? 4. Which number indicates the teres major muscle in the figure? 5. Which number indicates the coraco-brachialis muscle in the figure?	

6. Which of the following muscles are the third layer on the anterior surface of the forearm?

1. Flexor digitorum profundus muscle.
2. Flexor pollicis longus muscle.
3. Pronator quadratus muscle.
4. Flexor carpi ulnaris muscle.
5. Flexor digitorum superficialis muscle.

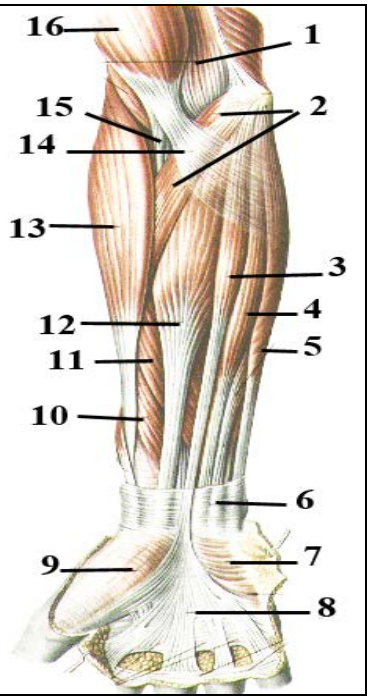
7. Which number indicates the anconeus muscle in the figure? 8. Which number indicates the infraspinatus muscle in the figure? 9. Which number indicates the long head of triceps brachii muscle in the figure?	

10. Which of the following muscles are the muscles of the thenar eminence?
    1. Abductor pollicis brevis muscle.
    2. Opponens pollicis muscle.
    3. Extensor pollicis longus muscle.
    4. Extensor pollicis brevis muscle.
    5. Flexor pollicis brevis muscle.

11. Which number indicates the brachialis muscle in the figure?

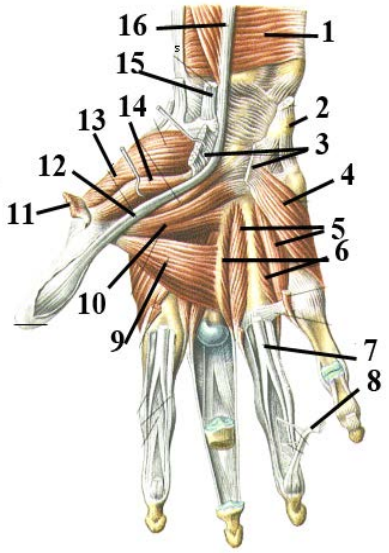
12. Which number indicates the flexor carpi ulnaris muscle in the figure?

13. Which number indicates the palmaris brevis muscle in the figure?



14. Which of the following muscles limit the thoracic triangle of the anterior axillary cavity?
    1. The contours of the coracobrachialis muscle.
    2. The contours of the pectoralis major muscle.
    3. The contours of the pectoralis minor muscle.
    4. The contours of the serratus anterior muscle.
    5. Inferior borders of the pectoralis major and minor muscles.
15. Which of the following structures limit the quadrilateral opening on the posterior wall of the axillary cavity?
    1. Humerus.
    2. Long head of the triceps brachii muscle.
    3. Inferior border of the subscapularis muscle.
    4. Superior border of the pectoralis major muscle.
    5. Superior border of the teres major muscle.
16. Which of following fasciae are not related to the muscles of the shoulder girdle?
    1. Deltoid fascia.
    2. Subscapularis fascia.
    3. Nuchal fascia.
    4. Supraspinatus fascia.
    5. Pectoral fascia.

17. What does the medial intermuscular septum of the arm separate?
    1. Biceps brachii muscle from coracobrachialis muscle.
    2. Long head of triceps brachii muscle from biceps brachii muscle.
    3. Brachialis and coracobrachialis muscles from medial head of triceps brachii muscle.
    4. Brachialis muscle from biceps brachii muscle.
    5. Lateral head of triceps brachii muscle from biceps brachii muscle.
18. Which of the following muscles are separated by the lateral intermuscular septum of the arm?
    1. Biceps brachii muscle from brachialis muscle.
    2. Brachialis muscle from brachioradialis muscle.
    3. Brachialis and brachioradialis muscles from lateral head of the triceps brachii muscle.
    4. Long head of the triceps brachii muscle from biceps brachii muscle.
    5. Bachioradialis muscle from biceps brachii muscle.
19. Which of the following structures limit the humeromuscular canal?
    1. Humerus
    2. Lateral head of the triceps brachii muscle
    3. Coracobrachialis muscle.
    4. Long head of the triceps brachii muscle.
    5. Brachialis muscle.

20. Which number indicates the adductor pollicis muscle in the figure? 21. Which number indicates the opponens digiti minimi muscle in the figure? 22. Which number indicates the palmar interossei muscles in the figure?	

23. What is there in the first (lateral) canal on the dorsal surface of the wrist?
    1. Tendon of the abductor pollicis longus.
    2. Tendon of the extensor carpi radialis longus.
    3. Tendon of the extensor digitorum.
    4. Tendon of the extensor pollicis longus.
    5. Tendon of the extensor pollicis brevis.

24. Which of the following muscles abduct fingers?
    1. Abductor pollicis longus.
    2. Flexor digiti minimi.
    3. Extensor indicis.
    4. Flexor pollicis longus.
    5. Interossei dorsales.
25. Which of the following muscles adduct fingers?
    1. Opponeus pollicis.
    2. Interossei palmares.
    3. Flexor pollicis longus.
    4. Interossei dorsales.
    5. Abductor pollicis longus.

Situational tasks

1. A 38-year-old man received a strong blow in the area of the dorsal surface of the right scapula below its spine. He was delivered to the trauma center. He complained of pain at the place of the injury and dysfunction of the upper limb. The doctor diagnosed a rupture of the muscles located on the posterior surface of the scapula below its spine.

Why did the doctor make the conclusion?

2. A 9-year-old boy was received a bruise of the lateral edge of the right forearm as a result of a fall from a bicycle. He was delivered to the trauma center. On examination a massive bruising and severe soreness on palpation in the upper third of the antero-lateral surface of the right forearm were revealed. The doctor diagnosed a rupture of the right brachioradialis muscle.

Why did the doctor make this conclusion?

3. An 18 year old soldier with a gunshot wound to the lower third of the forearm was delivered to the reception and sorting department of a military hospital. The victim cannot turn the hand inward. Sensitivity and active movements of the fingers are preserved.

Which of muscle damage did the soldier have?

4. A 46-year-old man turned to the surgeon of the regional clinic with burning pains in the distal phalanx of the right thumb. On examination, it was found out the following symtomps in this region: the swelling and hyperemia of the skin and increase of the pain during palpation.

Where is the spread of the inflammatory process possible?

5. The 46-year-old man turned to the surgeon of the regional clinic with burning pains in the distal phalanx of the right thumb. On examination, it the swelling and hyperemia of the skin and increase of pain during palpation on this region were found out.

Where is the spread of the inflammatory process possible?

6. A 38-year-old woman came to the surgeon of the district polyclinic with stinging pains in the region of the right little finger (5th finger). During the examination, it was found out the swelling and hyperemia of the skin with the increase in pain during palpation on the palmar surface of the middle phalanx of the little finger (5th finger).

Where and why is the spread of the inflammatory process most likely?

Memorize the following eponyms

Dupuytren's fascia (G. Dupuytren) is the palmar aponeurosis, *aponeurosis palmaris.* It is located in the middle deep part of the palm. It occupies the middle of the palm. It is triangular in shape, and of great strength and thickness. Its apex is continuous with the lower margin of the flexor retinaculum to receive the expanded tendon of the palmaris longus. Its base is continuous to base of 2-5 fingers.

Camper's Chiasm (P. Camper). The tendons of the flexor digitorum superficialis have a split at the end of them through which the tendons of flexor digitorum profundus pass.

Morenheim fossa (J.J. Mohrenheim) is the deltopectoral groove (triangle), *sulcus deltoideopectoralis*. It is an indentation in the muscular structure between the deltoid muscle and pectoralis major. It is the location through which the cephalic vein passes and where the coracoid process is most easily palpable.

Pirogov fascia (N.I. Pirogov) is the aponeurosis of the biceps brachii muscle of the arm, *aponeurosis m. bicipitis brachii*. It are the fibrous tendon bundles of the biceps brachii muscle, which pass through the cubital fossa and pass into the fascia of the forearm.

Assignment for students to assess the acquired knowledge of the class topic:

1. Name and show the muscles of the shoulder girdle on ta cadaver, relief models. Show the points of their origin and insertion on the bones. Demonstrate the movements are performed by each of the muscles during contractions.
2. Into what groups are the muscles of the arm divided? Name and show the muscles of the arm on the cadaver, relief models, dummies, and show the points of their origin and attachment on the bones. Demonstrate the movements to be performed by each of the muscles during contractions.
3. Explain and show the topography of the fasciae of the shoulder girdle and arm on the cadaver, relief models and dummies.
4. Name and show the borders of the axillary fossa. List the walls of the axillary cavity. What anatomic structures form them? Into what triangles is the an-

terior wall of the axillary cavity divided? Specify the apertures on the posterior wall of the axillary cavity.By what are each of them limited?
5. Name and show the groovesi and canal of the arm on the cadaver, relief models, and dummies. By what are each of them limited?
6. Into what groups are the muscles of the forearm divided? Name and show the muscles of the forearm on the cadaver, relief models, dummies, and show the points of their origin and insertion on the bones. Demonstrate the movements to be performed by each of the muscles during contractions.
7. Into what groups are the muscles of the hand divided? Name and show the muscles of the hand on the cadaver, relief models, dummies, and show the points of their origin and insertion on the bones. Demonstrate the movements to be performed by each of the muscles during contractions.
8. Explain and show the topography of the fasciae of the forearm and hand on the cadaver, relief models and dummies.
9. Name and show the sulci of the forearm on the cadaver, relief models, and dummies. By what are each of them limited?
10. Name and show the osteo-fibrous canals on the cadaver, relief models, and dummies. What synovial vaginas are located in these canals? What muscles tendons are located in the synovial vaginae?
11. Show the anatomical snuff box on the cadaver, the relief models. Draw the scheme of topography of the synovial sheaths and their muscle tendons on the hand. What is their clinical significance?

References:

Main:
1. P. 241-268.
2. C. 339-393.
3. Рис.(fig.) 408-421,426-438,446-462.
4. P. 224-245.

Additional:
5. P. 46,67-72,88-89,95-97, 103-107,112-119,131-136.

Topic 17 Muscles, fascia, thopography of lower limb

Aim of the class: to study the anatomy, function of muscles, fasciae, topographic formations of the lower limb.

Motivational characteristics of the topic

Knowledge concerning the topography, muscles and fasciae of the pelvis and the free part of the inferior limb are necessary for studying of vessels and nerves of this zone as well for clinic disciplines, topographic anatomy, surgery, kinetotherapy, traumatology, neurology, rehabilitation etc.

Main issuess of the topic

A student should demonstrate the knowledge of following issues:

1. Muscles of the pelvis.
2. Muscle of the thigh.
3. Fasciae of the pelvis and thigh.
4. Muscles of the leg.
5. Muscles of the foot.
6. Fascia of the leg and foot.
7. Topographic formations of the pelvis: suprapiriform foramen and infrapiriform foramen, obturator canal, muscular compartment and vascular compartment.
8. Femoral triangle, femoral and adductor canals.
9. Popliteal fossa, cruropopliteal canal, superior and inferior musculoperoneal canals, plantar grooves.
10. Tarsal tunnels.
11. Synovial tendon sheaths of the foot.

Information section and recommendations for self-directed work on the topic

1. When studying the muscles of the lower limb, consider their division according to the departments of the skeleton of the limb into: the muscles of the pelvis and the free lower limb. The muscles of the last-named group are subdivided into the muscles of the thigh, the muscles of the leg and the muscles of the foot.

2. When studying the function of the muscles of the lower limb, it keep in mind that they are thrown over the distal joints providing the main movements in them, namely: the main function of the pelvis muscles is to ensure the execution of the movements in the hip joint, the main function of the thigh muscles is to ensure the execution of the movements in the knee joint and etc. Polyarticular muscles, or their heads, when changing a fixed point, act on the other joints.

3. When studying the muscles of the pelvis, consider their subdivision into two groups: the internal and external muscles. Find the following internal muscles: the iliopsoas muscle and its parts (psoas major and iliacus muscles), psoas minor, piriformis and obturator internus muscles. Consider that the muscles of the external group are located in three layers. The external layer includes the gluteus maximus and tensor fasciae latae muscles. The middle layer is formed by gluteus medius, gemellus superior and gemellus inferior, quadratus femoris, and parts of obturator internus and piriformis muscles. The muscles of the last-named group exit the pelvic cavity. The deep layer is formed by the gluteus

minimus and obturator externus muscles. Find the enumerated muscles and their origin and insertion.

4. When studying the muscles of the thigh, understand their division into three groups: the anterior group (sartorius and quadriceps femoris muscles), medial group (gracilis, pectineus, adductor longus, adductor brevis and adductor magnus muscles) and posterior group (biceps femoris, semitendinosus and semimembranosus muscles). Find the enumerated muscles and their origin and insertion.

5. When studying the muscles of the leg, take in account their division into three groups: the anterior group (tibialis anterior, extensor digitorum longus and extensor hallucis longus muscles), lateral group (fibularis longus and fibularis brevis muscles) and posterior group. The posterior musclesof the leg should be studied in two layers. The superficial layer is made up of the triceps surae and plantaris muscles. The deep layer is formed by popliteus, tibialis posterior, flexor digitorum longus and flexor hallucis longus muscles.

6. When studying the muscles of the foot, consider that they, unlike the muscles of the hand, are located on the dorsal and plantar surfaces. Find the following muscles on the dorsal surface of the foot: the extensor digitorum brevis and extensor hallucis brevis muscles. The muscles of the plantar aspect of the are divided into three groups: the muscles of the eminence of the great toe (abductor halluces, flexor hallucis brevis, adductor halluces muscles), the muscles of the eminence of the little toe (abductor digiti minimi, opponens digiti minimi muscles) and the muscles of the median plantar eminence (flexor digitorum brevis muscle, quadratus plantae muscle, three plantar interossei muscles and four dorsal interossei muscles).

7. When studying the function of the muscles of the lower limb, it is necessary to take into account and model of the main movements when the moving point is located distally to the bone (at the fixed end), as well as the movement when changing the mobile end (which is important for performing exercises). Consider that the same muscles of the lower limb when performing different movements can be synergists and antagonists.

8. When studying the fasciae of the pelvis, find the fascia of the external surface of the pelvis. The gluteus fascia covers the group of gluteus muscle below the outer lip of the iliac crest and dorsal sacral surface. It continues downwards with fascia of the thigh. Identify the fasciae of the internal surface of the pelvis: the iliac fascia and the lumbar fascia. Find the following structures on the free lower limb: the fascia lata and its medial, lateral and posterior intermuscular septa, fascia of the leg, flexor retinaculum, superior extensor retinaculum and inferior extensor retinaculum, superior fibular retinaculum, inferior fibular retinaculum, plantar aponeurosis, dorsal fascia of the foot.

9. Find the following formations on the gluteal region: the suprapiriform foramen and infrapiriform foramen, obturator canal, muscular lacunae (compartment) and vascular lacunae, deep femoral ring.

10. Find the following formations on the femoral region: the femoral triangle, femoral canal and adductor canal, popliteal fossa, cruropopliteal canal, superior and inferior musculoperoneal canals, lateral and medial plantar sulci.
11. Find three fibrous tunnels (canals) under the flexor retinaculum and three fibrous tunnels (canals) under the extensor retinaculum. Define their contents (synovial sheaths of the tendons).
12. Find one fibrous tunnel (canal) under the superior peroneal retinaculum and two tunnels (canals) under the inferior peroneal retinaculum. Define their contents (synovial sheaths of the tendons).
13. Consider the structure, location and purpose of the digital synovial sheaths of the foot.
14. Write in the working dictionary and memorize the Latin names of the anatomical formations given in recommendation No. 1-13 of this block.

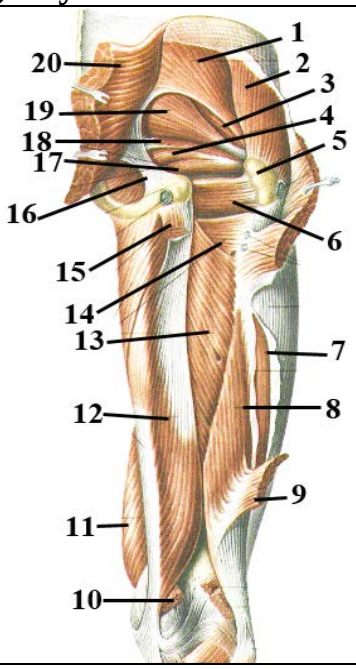
Visuals: a cadaver with dissected muscles of the trunk and the lower limb, a skeleton, a pelvis and separate bones of the lower limb, relief models, imitations, tables.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. Which number indicates the piriformis muscle in the figure?

2. Which number indicates the quadratus femoris muscle in the figure?

3. Which number indicates the short head of the biceps femoris muscle in the figure?

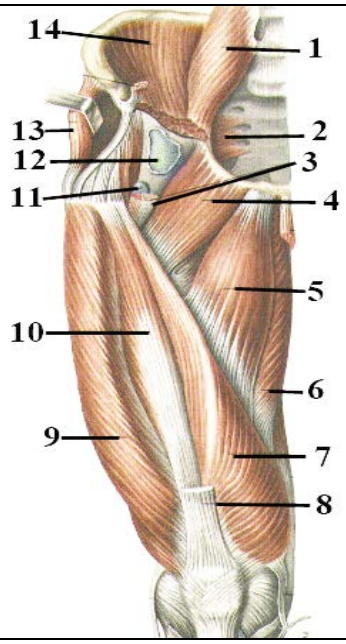


4. Which of the following is/are a synergist(s) of the rectus femoris muscle?
   1. Iliopsoas muscle.
   2. Pectineus muscle.
   3. Sartorius muscle.
   4. Tensor fasciae latae muscle.
   5. Gracilis muscle.

5. Which number indicates the iliac muscle in the figure?

6. Which number indicates the vastus lateralis muscle in the figure?

7. Which number indicates the adductor longus muscle in the figure?



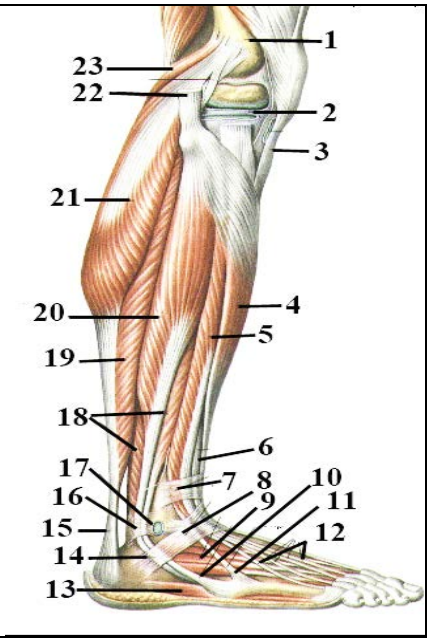
8. Which of the following structures limit the popliteal fossa?
   1. Biceps femoris muscle.
   2. Semimembranosus muscle.
   3. Popliteus muscle
   4. Laterale head of the gastrocnemii muscle
   5. Mediale head of the gastrocnemii muscle.

9. Which of the following muscles abduct the hip joint?
   1. Gluteus medius and gluteus minimus muscles.
   2. Biceps femoris muscle.
   3. Gluteus maximus muscle.
   4. Adductor magnus muscle.
   5. Semimembranosus muscle.

10. Which number indicates the soleus muscle in the figure?

11. Which number indicates the peroneus brevis muscle in the figure?

12. Which number indicates the extensor digitorum brevis muscle in the figure?



13. The adductor canal is located between the following muscles?
    1. Biceps femoris and vastus lateralis muscles.
    2. Rectus femoris and pectineus muscles.
    3. Iliopsoas and pectineus muscles.
    4. Vastus lateralis and rectus femoris muscles.
    5. Vastus medialis and adductor magnus muscles.

14. Which of the following statements concerning the femoral canal are correct?
    1. There is only the deep femoral ring normally.
    2. It has three walls.
    3. The exit is the hiatus saphenous.
    4. It is formed in the femoral triangle.
    5. It exists under normal condition.

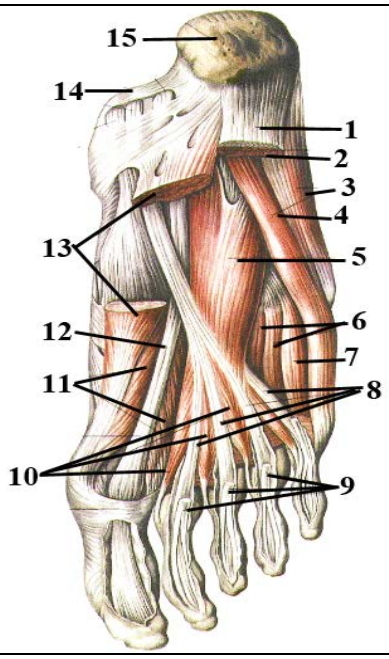
15. Which of the following formations are the medial border of the femoral triangle?
    1. Sartorius muscle.
    2. Adductor brevis muscle.
    3. Gracilis muscle.
    4. Inguinal ligament.
    5. Adductor longus muscle.

16. The superior fibular retinaculum is located:
    1. Form calcaneus to navicular bones.
    2. From talus to calcaneus.
    3. From lateral malleolus to calcaneus.
    4. From medial malleolus to talus.
    5. From medial malleolus to calcaneus.

17. Which number indicates the quadratus plantae muscle in the figure?

18. Which number indicates the abductor digiti minimi muscle in the figure?

19. Which number indicates the lumbricals muscles in the figure?



20. Which of the following muscles flex (plantar flexion) the foot:
    1. Triceps surae muscle.
    2. Flexor digitorum longus muscle.
    3. Flexor hallucis longus muscle.
    4. Tibialis anterior muscle.
    5. Tibialis posterior muscle.
21. Which of the following formation is/are located under the inferior fibular retinaculum?
    1. One synovial sheath.
    2. Two synovial sheaths.
    3. Three synovial sheaths.
    4. Four synovial sheaths.
    5. Six synovial sheaths.
22. Where is the vascular compartment located?
    1. Above the inguinal ligament.
    2. In front of the inguinal ligament.
    3. The medial aspect of the iliopectineal arch.
    4. Behind the iliopectineal arch.
    5. In the popliteal fossa.
23. Where is the medial plantar groove located?
    1. Between the flexor digitorum brevis and abductor digiti minimi muscles.
    2. Between the flexor digitorum brevis and flexor hallucis longus muscles.
    3. Between the medial border of the flexor digitorum brevis muscle and the lateral border of the abductor halluces muscle.
    4. Between the tendon of the flexor hallucis longus muscle and flexor digitorum brevis muscle.
    5. Between the fibers of the plantar aponeurosis.
24. Where is the lateral plantar groove located?
    1. Between the abductor digiti minimi and flexor digiti minimi brevis muscles.
    2. Between the lumbricals muscles.
    3. Between the plantar interossei muscles.
    4. Between the lateral border of the flexor digitorum brevis and abductor digiti minimi muscles.
    5. Between the quadratus plantare and flexor digitorum brevis muscles
25. Which of the following formations participate in the supporting of the transverse arch of the foot?
    1. Quadratus plantae muscle.
    2. Peroneus brevis muscle.
    3. Peroneus longus muscle.
    4. Adductor halluces muscle.
    5. Flexor digitorum brevis muscle.

Situational tasks

1. A 30-year-old man fell on the ice ground. He was delivered to the trauma center. He complained of the pain in the right wing of the ilium. A separation of the anterior superior iliac spine was revealed on the X-ray.

Which disorders of the movements will occur in the injured lower limb?

2. A 38-year-old man was received a deep cut on the dorsal surface of the foot. He was delivered to the trauma center. The doctor diagnosed a cut wound of the soft tissues with the damage to the tendons of the muscles located on the dorsal surface of the foot.

Which kind of movements help to diagnose the damage to the tendons of the muscles located on the dorsal surface of the foot?

3. A postinjection abscess in the left gluteal region was developed after the course of vitamin therapy and treatment with biostimulants. The surgeon suggested that the left gluteus maximuss muscle was completely damaged by the inflammatory process.

Which kind of movements of the hip joint help to diagnose the dysfunction of the left gluteus maximus muscle?

4. A 47-year-old man was a victim of a car accident. An open fracture of his left leg at the border of the middle and lower third was revealed. The ambulance doctor suggested after anesthesia that all the anterior muscles of the leg were completely damaged by the distal fragment of the tibia.

Which kind of movements of the foot help to diagnose the fracture?

5. A 14-year-old teenager had stepped on a nail and punctured his first toe. A puncture wound, swelling, pain during palpation of the plantar surface on the proximal phalanx of the first toe were revealed. A traumotologist suggested inflammation of the first digital synovial sheath of the flexor tendons.

Where could the inflammatory process spread along the tendon sheath of the first toe?

Memorize the following eponyms

Gruber's canal (**W.L. Gruber**) is the cruropopliteal canal, *canalis cruropopliteus* is located between posterior tibialis muscle in front and soleus muscle in the back. The tibial nerve and posterior tibial vessels pass through the canal.

Hunter's canal (J.Hunter) is the adductor canal (subsartorial canal), *canalis adductorius (femoropopliteus)* is an aponeurotic tunnel in the middle third of the thigh, extending from the apex of the femoral triangle to the opening in the adductor magnus, the adductor hiatus. It is an intermuscular cleft situated on the medial aspect of the middle third of the thigh on anterior compartment of thigh, and has the following boundaries: posterior wall - adductor longus muscle and adductor magnus muscle, lateral wall - vastus medialis muscle, anterior wall - vastoadductor intermuscular septum. The canal contains the femoral artery, femoral vein and branche of the femoral nerve (specifically,

the saphenous nerve). The femoral artery with its vein and the saphenous nerve enter this canal through the superior foramen. Then, the saphenous nerve and artery and vein of genus descendens exit through the anterior foramen, piercing the vastoadductor intermuscular septum. Finally, the femoral artery and vein exit via the inferior foramen (usually called the hiatus) through the inferior space between the oblique and medial heads of adductor magnus.

Gimbernat's ligament (**A. Gimbernat)** is the lacunar ligament, *lig. lacunare* is a ligament in the inguinal region that connects the inguinal ligament to the pectineal ligament near the point where they both insert on the pubic tubercle. The ligament limits the vascular lacunae from the medial side.

Jaubert's fossa (A.J. Jobert) is a fossa on the medial surface of the knee region. It is limited by the tendon of adductor magnus muscle in front; tendons of the semimembranosus, semitendinosus and gracilis musles on the posterior aspect; the upper surface of the medial condyle of the femur; the edge of the sartorius muscle on the superior aspect. The fossa is the access to the upper part of the popliteal artery.

Kloke's (Kloketov's) septum (J.G. Cloquet) is a femoral septum, *septum femorale*. It is part of the transverse fascia of the abdomen penetrated by the vessels. It covers the femoral ring (deep foramen of the femoral canal) in the medial part of the vascular lacuna.

The Scarpa's triangle (A. Scarpa) is the femoral triangle, *trigonum femorale.* The femoral triangle is bounded: superiorly by the inguinal ligament, medially by the medial border of the adductor longus muscle, laterally by the medial border of the sartorius muscle.

Spigel's muscle (A. van den Spiegel) is the sartorius muscle*; (m. sartorius*). It is a long, thin, superficial muscle that runs down the length of the thigh in the anterior compartment.

Assignment for students to assess the acquired knowledge of the class topic:

1. Name and show the musle of the pelvic girdle on a cadaver, relief models. Show the points of their origin and insertion on the bones. Demonstrate the movements are performed by each of the muscles during contractions.
2. Show the suprapiriform foramen and the infrapiriform foramen, the obturator canal on the cadaver, relief models, dummies burse. What are the suprapiriform foramen and the infrapiriform foramen limited by? The obturator canal, its walls and holes.
3. List the groups of the thigh muscles, their construction and functions. Name and show the thigh muscles on the cadaver, relief models and dummies. Show the points of their origin and insertion on the bones. Demonstrate the movements are performed by each of the muscles during contractions.
4. List and show the fasciae of the pelvic girdle and thigh on the cadaver, relief models and dummies. Explain their topography.

5. Show the musclar compartment, the vascular compartment, the femoral triangle, the iliopectineal and anterior femoral grooves, the femoral canal, the deep femoral ring, the saphenous opening, the adductor canal. What are they limited by? Where are they located?
6. Name and show the musle of the leg on the cadaver, relief models. Show the points of their origin and insertion on the bones. Demonstrate the movements are performed by each of the muscles during contractions.
7. Show the popliteal fossa, the cruropopliteal canal, superior and inferior musculoperoneal canals on the cadaver, relief models and dummies. What are they limited by? Where are they situated?
8. List the groups of the foot muscles, their construction and functions. Name and show the foot muscles on the cadaver, relief models and dummies. Show the points of their origin and insertion on the bones. Demonstrate the movements are performed by each of the muscles during contractions.
9. List and show the fasciae of the leg and foot on the cadaver, relief models and dummies. Explain their topography.
10. Name and show the plantar sulci on the cadaver, relief models and dummies. What are they limited by?
11. Name and show the flexor retinaculum, extensor retinaculum, superior and inferior extensor retinaculum and fibrous channels under them on the cadaver, relief models and dummies. What do they contain?
12. Draw the scheme of the topography of the synovial sheaths and their muscle tendons on the hand. What is their clinical significance?

References:

Main:
1. P. 268-298, 304-305.
2. C. 393-460.
3. Рис.(fig.) 258,335,336,477-483,492,497,498,502,516-524.
4. P. 224-245.

Additional:
6. P. 44-48,52-61,66-72,77,82-86,92-95,98-102,104-108,114-120.

Topic 18 Developmental and functional anatomy of the locomotor apparatus

Aim of the class: to find out the level of understanding and assimilation of theoretical issues in osteology, arthrology, myology, anatomy of the locomotor apparatus on X-rays; to check the obtained knowledge of the anatomical preparations and X-rays, tomograms.

Motivational characteristics of the topic

Knowledge of the general laws of the structure and development of the bones and their joints, skeletal muscles and their fasciae, topographic formations are important for the study of all clinical disciplines.

The main issues of the topic

1. Development of the bones.
2. Development of the joints.
3. Types of the muscle tissue.
4. Development of the skeletal muscles.
5. Auxiliary devices of the muscles.
6. Structure of the muscular system on X-ray and tomograms.

Information section and recommendations for self-directed work on the topic

1. A student should be able to demonstrate understanding of the following issues on the anatomical objects:

– development of the trunk skeleton;

– abnormalities, structural and age features of the skeleton of the trunk;

– development of the upper limb, variants of the structure and the developmental abnormalities;

– development of the lower limb, variants of the structure and the developmental abnormalities;

– anatomic distinctions between the lower and upper limb bones connected with their functions;

– development of the bones of the neurocranium, the age and the sex features, the variants of the structure and the developmental abnormalities;

– development of the bones of the viscerocranium, the age and the sex features, the variants of the structure and the developmental abnormalities;

– anthropometric points and measurements of the head, trunk, limbs;

– shapes of the skull, the cranial index (dolichocephalus, mesocephalus, brachycephalus);

– development of the joints;

– general data concerning the structure of the muscles;

– skeletal muscle as an organ;

– development and growth of the skeletal muscles:

– autochthonous, truncopetal, truncofugal muscles;

– functions of the muscles;

– auxiliary apparatus of the skeletal muscles:

fasciae;

synovial bursae;

synovial sheaths;

sesamoid bones.

– work of the muscles:

anatomical cross-sectional area;

physiologic cross-sectional area;

antagonism and synergism of muscles;

neuromotor unit;

levers of muscles.

– explain the term “topography”;

– topographic formations and interfascial spaces of the body regions and their clinical significance;

– osteofibrous canals and their clinical significance;

– synovial sheaths of the muscle tendons, the synovial bursae and their clinical significance.

2. For the correct interpretation of X-rays, tomograms of the locomotor apparatus, use the algoritm for their analysis below:

1) determination of an anatomical region;

2) determination of the projection of an area (organ);

3) pay attention to:

a) the size and the shape of the bones;

b) a final stage of the process of the development and the formation of the bone (physiological curve, epiphytical cartilages, growth zone, nucleus of ossification etc.);

c) estimation the intensity of the shadow of the bone (in comparison with the soft tissues, depending on the conditions of projection and on the summation of shadows);

d) examining contour of the bone to find: well defined outline of the shadow, smooth, continuous (with exeptionof unevenness in the region of the anatomical protrusions and roughnesses). Discontinuty of the outline with an incomplete process of synosteosis;

e) analysis of the internal shadow of the bone tissue (osteal trabecule of the spongy substance of epiphyss and the metaphysic, the line of synosteosis, the intensivity shadow of the compact substance, change of its thickness in different parts of the bones, the medullary canal, etc.);

4) examining the surrounding soft tissues. Pay attention to the outline of the shadow of the skin, a group of the muscles, the cavities of the body;

5) during the investigation of the joints pay attention to the form of the articular surfaces of the bones, relations of the joint, height and extent of X-ray articulat shadow (on examining the vertebral column to find the distance between the intervertebral disks).

3. Analyze X-ray photographs and tomograms using the above algorithm:

a) trunk;

b) head;

c) limbs.

4. During examining the joints, pay attention to the visible main elements of the joints and the features of their visualization on X-rays. Name the invisible elements of the joint and try to show their locations on the x-ray photographs, tomograms.

Visuals: a skeleton, a demonstration cadaver with dissected muscles of all areas of the body, relief models, imitations, X-rays, computer tomograms, tomograms, tables.

Test questions for self study and self-assessment or choice the right variant(s) of your answer:

1. Which of the following orders describe the formation of the curvatures of the vertebral column?
    1. Cervical-lumbar-sacral-thoracic.
    2. Cervical-sacral-thoracic-lumbar.
    3. Thoracic-cervical-lumbar-sacral.
    4. Cervical-thoracic-lumbar-sacral.
    5. Sacral-lumbar-pectoral-cervical.
2. Curvatures of the cervical part of the vertebral column (lordosis) is formed:
    1. At the end of the first month after birth.
    2. At the end of the second month after birth.
    3. At the end of the third month after birth.
    4. Before birth.
    5. At the beginning of the fourth month after birth.
3. Which of these statements incorrectly describe the female pelvis?
    1. It is wider than the male pelvis.
    2. The pubic angle is 70-75$^{o.}$
    3. The superior aperture has round shape
    4. The pelvic cavity is larger than the male pelvis.
    5. The distance between the iliac crests is longer than that of men.
4. Which types of muscle tissue are in the human body?
    1. Smooth muscle.
    2. Gastric muscle.
    3. Vascular muscle.
    4. Skeletal muscle.
    5. Cardiac muscle.

5. Which of the following formations are the components of the skeletal muscle?

1. Muscle fiber.
2. Endomysium.
3. Perimisium.
4. Epimysius.
5. Peritendium.

6. Which of the following formations are the sources of the skeletal muscle development?

1. Endoderm.
2. Mesoderm.
3. Somite.
4. Miotom.
5. Ectoderm.

7. Which of these statements correctly describe the functions of the skeletal muscles?

1. They help to retain the body in balance.
2. The function is to move an organism's body.
3. They control facial expression.
4. They participate in the breathing movements.
5. They participate in the formation of the intra-abdominal pressure.

8. Which of the following statements help to determine the force of the muscle contraction according its shap?

1. Anatomical cross-section (diameter).
2. Physiological cross-section (diameter).
3. It is determined by the total area of muscle origin (fasciae, other muscles).
4. It dependeds upon various class levers.
5. The presence of intermediate tendons.

9. Which of the following muscles have the same anatomical and physiological cross-sections (diameters)?

1. Long muscles.
2. Fusiform muscles.
3. Bipennate muscles.
4. Two-headed muscles.
5. Broad muscles.

10. What activities does the concept of "myodynamic work" include?

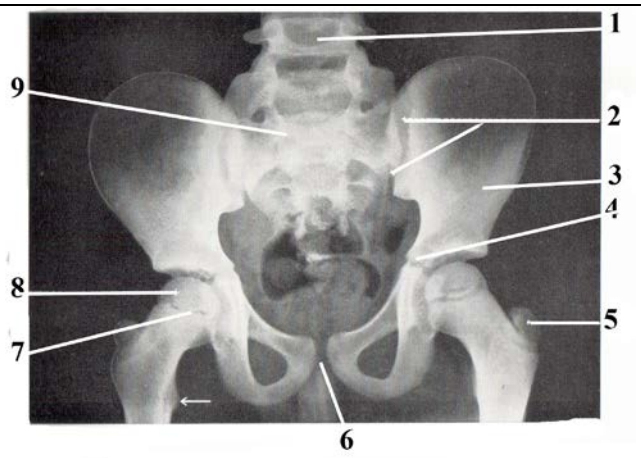
1. Overcoming work.
2. Isometric reduction.
3. Yield work.
4. Holding work.
5. Fixing work.

11. What does the efficiency of work muscle increase?
    1. Synovial tendon sheath.
    2. Synovial bursa.
    3. Synergist.
    4. It has not antagonists.
    5. Wide attachment on bones.

12. Which of the following groups of the skeletal muscles are classified according by development?
    1. Autochthonous muscle.
    2. Craniopetal muscle.
    3. Trunkopetal muscle.
    4. Trunkofugal muscle.
    5. Visceral muscle.

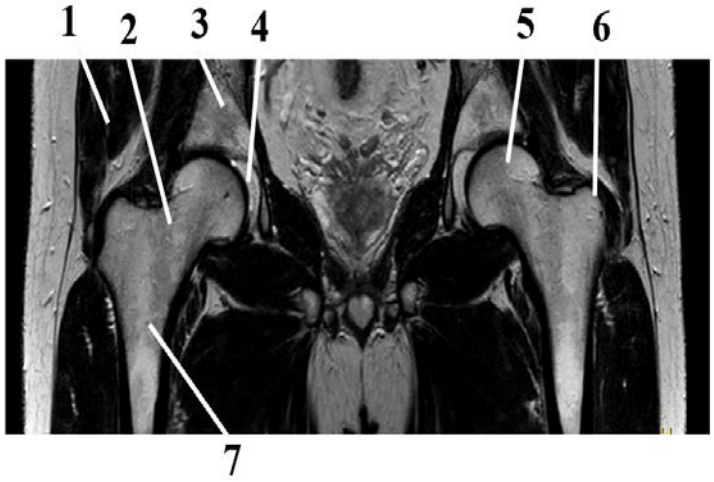
13. What concepts does the term “topography” include?
    1. Holotopy.
    2. Regiotope.
    3. Skeletonotopy.
    4. Craniotopy.
    5. Syntopy.

14. Which of the following formations are the landmarks for finding deeply located structures?
    1. Regions.
    2. Triangles.
    3. Fossae.
    4. Canals.
    5. Grooves.

15. Which number indicates the sacro-iliac joint in the figure? 16. Which number indicates the temporary synchondrosis in the figure? 17. Which number indicates the head of the femur in the figure? 18. Which number indicates the epiphysial cartilage of the femur in the figure?	

19. Which of the following statements are correct about fascial functions?
    1. The fasciae isolate of the muscles from the skin.
    2. The fasciae isolate the groups of the muscles.
    3. The fasciae increase a venous lumen.
    4. In case of the local inflammation the fasciae limit the focus of affection.
    5. The fasciae provision the muscle tropism.

20. Which of the following statements are correct about fibrous tunnels (canals)?
    1. They separate muscle tendons with different functions.
    2. They perform the role of blocks in muscle contraction.
    3. They revent muscle tendon displacement when changing the position of the part of the body.
    4. They provide muscle trophism.
    5. They protect the neurovascular bundles from compression.

21. Which number indicates the head of the femur in the figure? 22. Which number indicates the body of the ilium in the figure? 23. Which number indicates the greater trochanter of the femur in the figure?	

24. What are the anatomical and clinical significance of interfascial spaces?
    1. The fasciae isolate groups of the muscles.
    2. They protects organs and neurovascular bundles from compression.
    3. They surround the neurovascular bundles.
    4. They provide muscle trophism.
    5. They serve as paths for the spread of the inflammatory process.

25. What are the derivatives of the first branchial arch?
    1. Maxilla.
    2. Mandible.
    3. Masseter muscle.
    4. Buccal muscle.
    5. Temporal muscle.

Situational tasks

1. An X-ray examination revealed only 11 pairs of rib of a 10-year-old boy.

What does this testify for?

Could the changes of the number of thoracic and lumbar vertebrae be detected in this case?

2. A 11- years- old boy was admitted to the orthopedic department of a children's hospital with complaints of a moderate pain in the vertebral column, which was aggravated by physical activity. Clinical and radiological examination revealed a curvature of the vertebral column in the frontal plane.

What is the name of the curvature of the spine in the frontal plane?

What could be a cause of the curvature in the frontal plane?

3. A 14- years- old boy was broug to the orthopedic department of a children's hospital with complaints of mtoderate pain in the vertebral column. Clinical and radiological examination revealed a curvature of the thoracic part of the vertebral column in the sagittal plane. The deformation angle is opened anteriorly.

What is the name of the curvature of the spine in the sagittal plane with the angle open anteriorly? What could be the cause of this pathology?

4. A 6-years-old boy had a severe pain in the region of the calcaneal tuberosity after an unsuccessful jump. The calcaneal tubercle is separated from the calcaneus by a strip of enlightenment on the radiological examination (lateral projection).

Could it be argued that the strip of enlightenment is the place of the calcaneus fracture?

5. A 12-year-old boy had a pain in the ankle joint that was appeared after falling. A strip of enlightenment was determined between the body of the fibula and lateral malleolus on X-ray photographs.

Is it possible to get a conclusion about the fracture of the lateral malleolus based on these data?

6. A patient was received the X-ray photograph of the foot after the physical trauma. A fragment of the bony tissue was determined between the cuboid and V metatarsal bones.

Could it always be a piece of the bone?

7. A 1.5-year-old child was delivered to the surgical department of the hospital from the car accident. The child hit his head on the front panel of the passenger compartment. The child was unconscious. The bruise was in the frontal region. The zone of enlightenment with uneven contours from the sagittal suture to the glabella was detected on the x-ray photograph of the head in the direct projection.

Is this the evidence of the fracture of the frontal bone? Why?

8. The act of sucking was revealed a defect in a newborn . The examination of the hard palate was detected the cleft palate.

Explain the development of the birth defect during the human development.

9. Two 68-year-old women were delivered to the trauma center with the diagnosis of humeral fracture. They had the pain and could not perform the movements of the right upper limb. According to the results of an X-ray examination a doctor diagnosed that one of them had a fracture of the anatomical neck and the other had a fracture of the surgical neck of the right humerus. The treatment tactics for intraarticular and extraarticular fractures are different.

Could any of these fractures be intraarticular? Help your future colleague, please.

Memorize the following eponyms

Looser's zone (E. Looser) is a light strip on the X-ray of the bone (syn.: Looser zone of enlightenment), located transversely to its length on the background of the image of the normal bone structure. It is a sign of bone remodeling and resorption under the influence of excessive physical exertion.

Luschka's fork (H. Luschka) - rib fork is an anomaly of the development of the rib, manifested by bifurcation of its anterior (sternal) end.

Vesalius bone (A. Vesalius) is the bone of the anterior fontanelle, *os fonticuli anterioris*, it is the additional bone formed at the site of the anterior (large, or frontal) fontanelle.

Wormian bones (O. Worm) are extra bone pieces that can occur within a suture (joint) in the skull.

Goethe's bone (J.W. Goethe), the incisive bone, *os incisivum*, (synonym Kelliker bone (H.T.A. Killiker). It is the portion of the maxilla adjacent to the incisors.

Assignment for students to assess the acquired knowledge of the class topic:

1. Describe the early stages of the human embryonic development.
2. Describe the germinal layers and their derivatives.
3. Describe the development of the bones, joints, and muscles.
4. Enumerate the autochthonous, truncipetal, truncifugal muscles on the cadaver, relief models, dummies.
5. Give the interpretation of radiographs and tomograms of the head, trunk, limbs according by the algorithm.

References:

Main:

1. P. 30-47,57-69,74,115-116,121,128,145,156-159,178-184,298-305.
2. C. 10-21,24-25,2733,35,38,43,46-51,87,94,105,116,118,125,127, 140,148-149,156,159170-172,197,201,210,221,227,235,238,243-252.
3. Рис.(fig.) 156.
4. P. 224-245.

Additional:

5. P. 78.
7. P. 4.

Topic 19 Final control class on the sceletal muscle preparations

Aim of the class: to determine the level of academic competencies (knowledge, skills) of students about the functional anatomy of skeletal muscles, taking into account their importance for the clinic.

Motivational characteristics of the topic

Myology is the basic section for the study of all subsequent sections of anatomy and clinical disciplines: traumatology, orthopedics, surgery, neurology, physiotherapy, physiotherapy, sports medicine, etc.

The main statements of the topic

The students shouldt be able to show the places of the origin and the insertion of the muscles; should be able to simulate the movements performed during the contraction of each muscle; should be able to determine the muscle groups of antagonists and synergists for each movement; remember which of the muscles are autochthonous, trunkopetal, trunkofugal muscles.

A student should demonstrate the knowledge of the following issues:

1. Muscles of the facial expression: structure, functions.
2. Masticatory muscles: structure, functions, fascia.
3. Muscles of the neck: group and individual characteristics, functions.
4. Topography of the neck.
5. Fasciae and intersfascial spaces of the neck, their clinic significance.
6. Muscles and fasciae of the thorax: topography, structure, functions.
7. Diaphragm as an organ: structure, parts, functions, foramens and their contents.
8. Muscles of the abdomen: classification, structure, functions.
9. Abdominal press: anatomy and functions. White line of the abdomen. Rectus sheath.
10. Inguinal canal: topography, walls, foramens and their contents.
11. Weak places of the abdominal wall.
12. Muscles and fasciae of shoulder girdle: structure, functions.
13. Muscles and fasciae of the arm: structure, functions. Grooves of the arm. Humeromuscular canal.
14. Muscles and fasciae of the forearm: structure, functions. Grooves of the forearm.
15. Muscles of the hand: classification, functions.
16. Axillary region: fossa, cavity, foramenae, triangles.
17. Canals and synovial sheaths of the hand, their contents.
18. Muscles of the lower limb: classification, structure, functions.
19. Muscles of the thigh: classification, structure, functions.

20. Muscles of the leg: classification, structure, functions.
21. Muscles of the foot: classification, structure, functions.
22. Active mechanisms for strengthening the arches of the foot.
23. Comparative characteristics of the muscles of the upper limb and muscles of the lower limb.
24. Anatomy of the topographic formations of the pelvis.
25. Femoral canal: topography, walls, foramenae, clinical significance.
26. Anatomy of topographic structures of the thigh: compartment, grooves (sulci), adductor canal.
27. Anatomy of the topographic formations of the popliteal fossa. Topographic formations of the leg.
28. Canals and synovial sheaths of the foot, their contents.

Test questions for self study and self-assessment
or choice the right variant(s) of your answer:

1. What are the components of skeletal muscle?
    1. Head.
    2. Body.
    3. Belly.
    4. Tendon.
    5. Tail.

2. What muscle shape and structure are distinguished in the modern classification?
    1. Long muscles.
    2. Fusiform muscles.
    3. Bundle muscles.
    4. Multipennate muscles.
    5. Single-tendon muscles.

3. Which of the following belongs to the auxiliary apparatus of the skeletal muscles?
    1. Fascia.
    2. Synovial bursae.
    3. Sheath.
    4. Synovial sheath.
    5. Sesamoid bones.

4. Where does rectus femoris muscle originate from?
    1. Intertrochanteric line.
    2. Anterior superior iliac spine.
    3. Medial lip of linea aspera.
    4. Lateral lip of linea aspera.
    5. Anterior inferior iliac spine.

5. Which of the following muscle participate to lift the scapula and the clavicle?
    1. Teres major muscle.
    2. Levator scapulae muscle.
    3. Rhomboid major and rhomboid minor muscles.
    4. Sternocleidomastoid muscle.
    5. Trapezius muscle.
6. What is located under retinaculum extensorum of the hand in the 2nd canal (from the first finger)?
    1. Tendon of the extensor digiti minimi muscle.
    2. Tendon of the extensor digitorum muscle.
    3. Tendon of the extensor indicis muscle.
    4. Tendon of the extensor carpi ulnaris muscle.
    5. Tendon of the extensor carpi radialis longus and the extensor carpi radialis brevis muscles.
7. What is located within the upper limb?
    1. Axillary fossa.
    2. Humeromuscular canal.
    3. Cubital fossa.
    4. Interscalenum space.
    5. Carpal tunnel.
8. Which of the following structures has a connection with the inferior aspect of the popliteal fossa?
    1. Canalis musculoperoneus superior.
    2. Sulcus plantaris medialis.
    3. Femoral canal.
    4. Canalis cruropopliteus.
    5. Canalis musculoperoneus inferior.
9. What is the femoral triangle limited by?
    1. Inguinal ligament.
    2. Sartorius muscle.
    3. Vastus mediaiis muscle.
    4. Pectineus muscle muscle.
    5. Adductor longus muscle.
10. Which of the following muscles does not belong to the hypothenar eminence?
    1. Palmaris brevis muscle.
    2. Abductor digiti minimi muscle.
    3. Lumbrical muscles.
    4. Opponens digiti minimi muscle.
    5. Flexor digiti minimi muscle.

11. Which of the following muscles move the mandibule to the right (left) side?
    1. Masseter muscle.
    2. Lateral pterygoid muscle (of the opposite side).
    3. Temporal muscle.
    4. Geniohyoid muscle.
    5. Lateral pterygoid muscle (of the its side).
12. Where is the interscalene space located?
    1. Between scalenus medius and scalenus posterior muscles.
    2. Between scalenus anterior and scalenus medius muscels.
    3. Between thyrohyoid and omohyoid muscles.
    4. Between sternothyroid and scalenus medius muscles.
    5. Between scalenus posterior and thyrohyoid muscles.
13. Which of the following statements correctly describes the facial muscles?
    1. They provide facial expressions.
    2. They change the shape and the position of the skin folds.
    3. They are located around the natural openings of the head.
    4. They participate in the articulation of the speech.
    5. They are woven into the skin.
14. Which of the following formation(s) does/do not find in the body of the healthy person?
    1. Inguinal canal.
    2. Obturator canal.
    3. Adductor canal.
    4. Femoral canal.
    5. Carotid canal.
15. Which of the following muscles pronate the foot (raising the lateral edge together with the abduction of the foot)?
    1. Extensor digitorum longus muscle.
    2. Tibialis anterior muscle.
    3. Tibialis posterior muscle.
    4. Peroneus longus muscle.
    5. Peroneus brevis muscle.
16. Which of the following muscles supinate the foot (raising the medial edge with bringing the foot inward)?
    1. Flexor digitorum longus muscle.
    2. Tibialis anterior muscle.
    3. Tibialis posterior muscle.
    4. Triceps surae muscle.
    5. Flexor hallucis longus muscle.

17. Which of the following topographic formations are located in the forearm and hand?
    1. Canalis carpalis.
    2. Canalis carpi ulnaris.
    3. Canalis carpi radialis .
    4. Canalis nervi radialis.
    5. Sulcus medianus.
18. Which of the following muscle participate in the flexion of the hip joint?
    1. Iliopsoas muscle
    2. Pectineus muscle
    3. Rectus femoris muscle
    4. Vastus lateralis
    5. Sartorius muscle.
19. Which of the following sheaths are located below of the superior peroneal retinaculum?
    1. Two synovial sheaths.
    2. One common synovial sheath.
    3. Three common synovial sheaths.
    4. Four common synovial sheaths.
    5. Five common synovial sheaths.
20. Which of the following muscles abduct the wrist joint?
    1. Abductor pollicis longus.
    2. Extensor carpi radialis longus.
    3. Extensor carpi radialis brevis.
    4. Extensor carpi radialis longus, flexor carpi radialis.
    5. Flexor carpi radialis.
21. Where is the femoral canal located?
    1. Posteriorly to the inguinal ligament.
    2. Inferiorly to the inguinal ligament .
    3. In the ventral abdominal wall.
    4. Into the lesser pelvic cavity.
    5. Laterally to the femoral vein.
22. Which of the following structures form the inferior musculoperoneal canal?
    1. Fibula.
    2. Peroneus brevis muscle.
    3. Peroneus longus muscle.
    4. Flexor hallucis longus muscle.
    5. Tibialis posterior muscle.

23. Which of the following muscles flex the vertebral column?
    1. Rectus abdominis muscle.
    2. Scalenus anterior, scalenus anterior, scalenus posterior muscles.
    3. External oblique, internal oblique muscles.
    4. Longus colli muscle.
    5. Transversus abdominis muscle.
24. Which of the following muscles decrease the volume of the chest?
    1. Innermost intercostal muscles.
    2. Scalenus anterior, scalenus anterior, scalenus posterior muscles.
    3. Transversus thoracis muscle.
    4. Pectoralis major and pectoralis minor muscles.
    5. Subcostales muscles.
25. Which formation(s) of the diaphragm protect(s) the aorta from the squeeze?
    1. Lateral arcuate ligament.
    2. Medial arcuate ligament.
    3. Median arcuate ligament.
    4. Central tendon.
    5. Left crus of diaphragm.

Situational tasks

1. In case of a clavicle fracture, the typical displacement of the fragments is the position when the proximal fragment is displaced up and back, and the distal fragment is displaced forward and down.

Explain this position of the clavicle, using the knowledge of the origin of the muscle on the clavicle and the direction of their traction during contraction?

2. A 34-year-old man performed installation work. He was hit by a concrete beam in the region of the right shoulder joint and was delivered to the district hospital at weekend. He complained of the pain and the dysfunction of the upper limb. The doctor revealed the pain during palpation of the region of the greater tubercle of the humerus. The shoulder joint was turned inwards. When monitoring the implementation of the active movements by the right upper limb, the experienced doctor diagnosed the fracture of the greater tubercle of the right humerus.

Enumerate the symtomps which help to diagnose the fracture of the greater tubercle of the right humerus.

3. A 38-year-old man was delivered to the district hospital. He had received a log strike in the anterior aspect of his right arm. He complained of the pain of his right arm and dysfunction of the upper limb. The doctor revealed pain on palpation on the anterior surface of the proximal part of the right humerus. The

shoulder joint turned outward. An experienced doctor diagnosed a fracture of the lesser tubercle of the right humerus and its crest.

Enumerate the symtomps to help to diagnose the fracture of the lesser tubercle and its crest of the right humerus.

4. A 42-year-old woman hit the stone with her right arm. She was delivered to the hospital. She complained of the pain in the injured place and dysfunction of the upper limb. The doctor revealed unusual ("pathological") mobility, deformation and pain in the upper third of the arm. A strip of enlightenment was determined in the upper third of the humerus. The proximal fragment is retracted and rotated outwards, and the distal fragment is displaced upward and rotated inwards.

Between the origins of which muscles is the humerus broken?

5. A 52-year-old man fell from a horse and hit his left arm. He was delivered to the hospital. He complained of pain and dysfunction of the upper limb. The doctor revealed deformation and pain during palpation of the upper third of the arm. An X-ray examination revealed a fracture of the diaphysis of the humerus in the upper third. The central (proximal) fragment is displaced posteriorly and inward, and the peripheral (distal) fragment is displaced upward, outward, and slightly forward.

Between the origins of which muscles is the humerus broken?

6. A 47-year-old man was delivered to the hospital from the accident. He complained of severe pain in the lower third of his left thigh. He could not perform movements of the lower limb. The doctor diagnosed a diaphysis fracture of the left femur in the lower third with a displacement of the distal fragment to the back. The proximal fragment is displaced inside.

Which muscles make these displacements of the femoral fragments?

7. A 17-year-old boy was delivered to the hospital from the accident. He had a small wound on the right lateral surface of the chest at the level of the axillary fossa.The boy could not abduct the right arm above the horizontal level. Based on this symtom the doctor suggested a damage of the long thoracic nerve which innervates some muscle.

The paralysis of which muscle diagnosed the doctor?

8. A 56-year-old man came to the surgeon of the clinic with the complaints of difficulty in moving the head, neck and upper limb. After the examination performed together with a neurologist, the doctor diagnosed neuritis of the external branch of the left accessory nerve innervating the sternocleidomastoid and trapezius muscles of its side.

Comment on the basis of what symptoms the doctors diagnosed neuritis of the accessory nerve.

9. A 23-year-old man came to the surgeon clinic with the complaints of a change in facial expressions. The disease is associated with previous bilateral

inflammation of the parotid gland. The doctor asked the patient to tighten his lips and stretch out like a tube and diagnosed the damage to a branch of the facial nerve which innervates the facial muscles. The patient was not able to perform this movement.

Which muscles was not controled by the patient?

10. A 33-year-old man revealed a foot equinus, which was developed as a result of compression of the common peroneal nerve by an improperly applied plaster boot. The doctor diagnosed this complication. He was aware of the fact that the common peroneal nerve innervates the anterior and lateral groups of the shin muscles, the dorsal muscles of the foot.

Describe the position of the foot in this case.

A list of questions for final assessment class on the preparations of muscles.

Block 1. Show and name in Latin:

1. Trapezius muscle.
2. Latissimus dorsi muscle.
3. Levator scapulae muscle.
4. Rhomboid major and rhomboid minor muscles.
5. Serratus posterior inferior muscle.
6. Serratus posterior superior muscle.
7. Splenius capitis muscle and splenius cervicis muscle.
8. Iliocostalis muscle.
9. Longissimus thoracis, longissimus cervicis, longissimus capitis muscles.
10. Spinalis thoracis, spinalis cervicis, spinalis capitis muscles.
11. Semispinalis thoracis, semispinalis cervicis, semispinalis capitis muscles.
12. Multifidus lumborum, multifidus thoracis, multifidus cervicis muscles.
13. Rotatores lumborum, rotatores thoracis, rotatores cervicis muscles.
14. Interspinales lumborum, interspinales thoracis, interspinales cervicis muscles.
15. Medial lumbar intertransversarii, thoracic intertransversarii, medial posterior cervical intertransversarii muscles.
16. Levatores costarum muscle.
17. Rectus capitis posterior major, rectus capitis posterior minor muscles.
18. Obliquus capitis superior, obliquus capitis inferior muscles.
19. Pectoralis major, pectoralis minor muscles.
20. Subclavius muscle.
21. Serratus anterior muscle.
22. Internal intercostal muscle, external intercostal muscles muscle.
23. Transversus thoracis muscle.
24 Subcostales muscle.
25. Rectus abdominis.
26. External oblique and internal oblique muscle.

27. Pyramidalis muscle.
28. Transversus abdominis muscle.
29. Quadratus lumborum muscle.
30. Platysma muscle.
31. Sternocleidomastoid muscle.
32. Digastric muscle.
33. Stylohyoid muscle.
34. Mylohyoid muscle.
35. Geniohyoid muscle.
36. Sternohyoid muscle.
37. Sternothyroid muscle.
38. Omohyoid muscle.
39. Thyrohyoid muscle.
40. Scalenus posterior, Scalenus medius, Scalenus anterior.
41. Longus capitis, Longus colli muscles.
42. Rectus capitis anterior, Rectus capitis lateralis muscles.
43. Occipitofrontalis muscle.
44. Temporoparietalis muscle.
45. Corrugator supercilii muscle.
46. Procerus muscle.
47. Orbicularis oculi muscle.
48. Nasalis muscle.
49. Orbicularis oris muscle.
50. Depressor anguli oris muscle.
51. Depressor labii inferioris muscle.
52. Mentalis muscle.
53. Levator anguli oris muscle.
54. Zygomaticus major and Zygomaticus minor muscles.
55. Buccinator muscle.
56. Masseter muscle.
57. Temporal muscle.
58. Medial pterygoid and Lateral pterygoid muscles.
59. Deltoid muscle.
60. Supraspinatus muscle.
61. Infraspinatus muscle.
62. Teres minor and Teres major muscles.
63. Subscapularis muscle.
64. Coracobrachialis muscle.
65. Brachialis muscle.
66. Biceps brachii muscle.
67. Anconeus muscle.
68. Triceps brachii muscle.

69. Pronator teres and Pronator quadratus muscles.
70. Brachioradialis muscle.
71. Flexor carpi radialis and Flexor carpi ulnaris muscle.
72. Palmaris longus muscle.
73. Flexor digitorum profundus and Flexor digitorum superficialis muscles.
74. Flexor pollicis longus muscle.
75. Extensor carpi radialis longus and Extensor carpi radialis brevis muscles.
76. Extensor carpi ulnaris muscle.
77. Extensor digiti minimin and Extensor digitorum muscles.
78. Extensor pollicis longus muscle.
79. Abductor pollicis longus muscle.
80. Supinator muscle.
81. Extensor indicis muscle.
82. Abductor pollicis brevis muscle.
83. Abductor pollicis brevis muscle.
84. Opponens pollicis muscle.
85. Adductor pollicis muscle.
86. Palmaris brevis.
87. Abductor digiti minimi.
88. Flexor digiti minimi brevis.
89. Lumbricals muscle.
90. Opponens digiti minimi muscle.
91. Dorsal interossei and Palmar interossei muscles of the hand muscles.
92. Iliopsoas (Iliacus and Psoas major) muscles.
93. Psoas minor muscle.
94. Obturator internus and Obturator externus muscles.
95. Piriformis muscle.
96. Quadratus femoris muscle.
97. Gemellus superior and Gemellus inferior muscles.
98. Gluteus maximus, Gluteus medius, Gluteus minimus muscles.
99. Sartorius muscle.
100. Quadriceps femoris (Rectus femoris, Vastus lateralis, Vastus medialis, Vastus intermedius) muscles.
101. Biceps femoris muscle.
102. Semitendinosus muscle.
103. Semimembranosus muscle.
104. Gracilis muscle.
105. Pectineus muscle.
106. Adductor longus, Adductor brevis, Adductor magnus, Adductor minimus muscles.
107. Triceps surae (Gastrocnemius, Soleus) muscles.
108. Flexor digitorum longus and Flexor hallucis longus muscles.

109. Tibialis anterior and Tibialis posterior muscles.
110. Extensor digitorum longus, Extensor hallucis longus muscles.
111. Fibularis longus and Fibularis brevis muscsle.
112. Extensor hallucis longus muscle.
113. Adductor halluces and Abductor halluces muscle.
114. Flexor hallucis brevis muscle.
115. Abductor digiti minimi and Flexor digiti minimi brevis muscles.
116. Quadratus plantae muscle.
117. Flexor digiti minimi brevis muscle.
118. Lumbricalis.
119. Plantar interossei and Dorsal interossei muscles.

Block 2. Show and explain (structure, topography, functions).
1. Deep muscles of the back.
2. Superficial muscles of the back.
3. Deep muscles of the thorax.
4. Superficial muscles of the thorax.
5. The diaphragm: structure, topography, functions.Developmental abnormalities. The weak places of the diaphragm, clinical significance.
6. Abdominal regions (epigastric, hypochondrium, lateral, umbilical, pubic, inguinal).
7. The weak places of the anterior abdominal wall.
8. The linea alba.
9. The sheath of the rectus abdominis muscle: structure, topography, clinical significance.
10. The inguinal canal: walls, rings, content, clinical significance.
11. Muscles of the abdomen: classification, structure, topography, functions.
12. The structure of the anterior, posterior, lateral walls of the abdominal walls.
13. The superficial muscles of the neck.
14. Muscles situated above the hyoid bone.
15. Muscles situated bellow the hyoid bone.
16. The deepl muscles of the neck.
17. Topography of the neck (regions, triangles, spaces).
18. Muscles of the calvaria of the scull.
19. Muscles of the eyelid and the orbit.
20. Muscels of the nose.
21. Muscels of the mouth.
22. Masticatory muscles. The fasciae of the head.
23. Muscles of the shoulder girdle – structure, topography,functions
24. Muscles of the arm – structure, topography, functions.

25. Anterior group and posterior group of the muscles of the forearm: structure, topography, functions.
26. Muscles of the hand: structure, topography, functions. The palmar aponeurosis.
27. Topography of the axillary region.
28. The axillary fossa, axillary cavity: walls, orifices, triangles, contents.
29. The grooves and canals of the arm, the forearm, the hand.
30. Topography of the cubital fossa.
31. External muscles of the pelvic girdle.
32. Internal muscles of the pelvic girdle.
33. Muscles of the thigh: classification, structure, topography, functions.
34. Muscles of the leg: classification, structure, topography, functions.
35. Muscles of the foot: classification, structure, topography,functions.
36. The fasciae of the lower limb: structure, topography, derivatives.
37. Topographical structures of the hip region: orifices, canals, compartments and their walls and content.
38. Topography of the thigh and of the popliteal fossa: grooves, canals, orifices and their content
39. Femoral canal and its walls. The femoral ring, and saphenous opening.
40. Adductor canal, its walls and connections.
41. Cruropopliteal canal, its walls, content, and connections.
42. Superior musculoperoneal canal, its walls, content, and connections.
43. Inferior musculoperoneal canal, its walls, content, and connections.
44. Topography of the foot: canals, grooves, content.
45. General myology: the structure of the muscles and their parts. The concept of the endomysium, the perimysium, the aponeurosis, the tendinous.
46. Classification of the muscles according their shape, topography,structure, origin, functions, development.
47. Levers of the muscles and the work of the muscles.
48. Auxiliary structures of the muscles. Structural peculiarities of the fasciae. The role of the fasciae in muscle activity.
49. General myology, concept of the anatomical and physiological diameters
50. Development of the muscles, concept of the mesoderm, somites, myotome.
51. Concepts about norm, variants of norm, and developmental anomalies of muscles.
52. Anatomy of the fasciae and fascial spaces of the back.
53. Anatomy of the fasciae and fascial spaces of the chest.
54. Anatomy of the fasciae and fascial spaces of the abdomen.
55. Anatomy of the fasciae of the neck.The interfascial spaces of the neck.
56. Anatomy of the fasciae and fascial spaces of the head.
57. Anatomy of the fasciae and fascial spaces of the arm, forearm, hand.

58. Anatomy of the fasciae and fascial spaces of the pelvis, thigh, leg, foot.

References:

Main:

1. P. 3-305.
2. C. 241-460
3. Рис.(fig.) 25-30, 48, 49, 58,59, 156, 171-177, 185-188,191,192,245-258, 335, 336, 408-421, 426-438, 446-462, 477-483,492, 497, 498, 502, 516-524.
4. P. 173-286.

Additional:

5. P. 42-46,59-72,78,88-89,95-97,103-108,112-119,131-136,193-195.
6. P. 4,44-48,52-61,66-72,77,82-86,92-95,98-102,104-108,114-120,185,188,189,202-218,341-343,.
7. P. 6,8,11,16-17,50-56,66-75,77-85.

Answers to test questions

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6	Topic 7
1	5	1,2,3,4	2	3	1,2,3	3	1
2	2,3	1,2,3	3	15	1	3	6
3	1,3,4,5	1,3,5	2	7	1,2,3,4	11	20
4	1,2,3,4	8	4	1, 4	12	13	1,3,4,5
5	2,4,5	2	12	1,3,4	4	1,2,3,5	1,3,4,5
6	1	6	5	10	7	12	2
7	1	5	3,9	6	7	9	28
8	3	3	13	18, 19	1	3	7
9	2	3	1,3,4,5	5	13	2,3,4,5	1,3,4,5
10	2	7	1,2,3	1,2,4,5	2,3,4,5	1,2,3	2,3,4
11	3	9	5	1,3,4,5	1,2,3,5	1,2,3,4	16
12	1	1	3	14	1,2,3	1,3,4,5	13
13	1,2,5	3	12	1	3	1,3,4,5	6
14	1,2,3,4	5	10	10	5	1,2,4,5	1,2,3,5
15	1,2,3	7	14	4	8	2,3,4,5	5
16	1,2,3,4,5	4	3,9	9	3	20	3
17	1,2,3,4,5	1,2,3	7	6	15	10	2,5
18	4,5	2	4	1,2,3,4	24	1	2
19	3	1,5	9	1,2,3,4	1,4,5	5	2,3,4,5
20	1,2,3	11	11	14	1,2	1,2,3,4,5	1,3
21	4,5	6	5	17	1,2,3,4,5	1,2,3,4,5	12
22	1,2,3,5	1	1,2,3,4	8	1,2,4,5	2	6
23	C	2	2,3,4,5	3	1	16	2
24	D	6	1,2,3,5	1	3	9	4
25	B	2	1,3,5	10	4	10	4

№	**Topic 8**	**Topic 9**	**Topic 10**	**Topic 11**	**Topic 12**	**Topic 13**
1	3	1,3,4	1,3,4,5	6	6	1,2,3,5
2	3	3	1,2,4	7	2	2
3	6	1	2,3,4,5	3	3	17
4	3	3	1,3,4,5	1,2,5	1	8
5	4	3	2,3,4,5	1,4,5	10	2
6	3	2,3,4,5	2	4	2	3
7	1	1	1	1,2,3,4	7	22
8	4	8	3	2	2,3	18
9	2	10	2	6	1,2,5	13
10	1,3,4,5	2	10	3	6	6
11	1,2,3	1	5	3	3	3
12	1,2	7	4	1,2,4,5	1	5
13	1,2,4	8	4	4	1,2,3,5	2
14	4	1	3	2,3,4,5	4	4
15	1,4,5	1,2,3,4	2	14	3	3
16	1,4	1	7	3	2	1,2,3,4
17	2,3,4,5	2,5	4,6	12	3,4,5	1,3
18	1,2,3,5	2	2	1,2,3,5	11	2
19	17	5	4	19	7	1,2,3
20	1	14	1	3	3	1,3,4
21	6	12	11	5	8	1,3
22	1	3	4	1	10	4,5
23	16	3	3	3	11	4
24	6	2	1	3	1,2,3,5	1,2,3,4
25	10	4	5	2,4	1,2,4,5	1,2,3,5

№ теста	**Topic 14**	**Topic 15**	**Topic 16**	**Topic 17**	**Topic 18**	**Topic 19**
1	1,2,3	1,2,3	2,4	19	4	1,3,4,5
2	2	3,4	1	6	2	1,2,4
3	9	2	19	8	2	1,2,4,5
4	7	4,21	3	1,2,3,4	1,3	5
5	13	16,17,18	15	14	1,2,3,4,5	2,3,4,5
6	9	5	1,2	9	2,3,4	5
7	8	7	9	5	1,2,3,4,5	1,2,3,5
8	2,5	2	17	1,2,4,5	2,4	4
9	1,2,4,5	17	14	1	2,5	1,2,5
10	10	10	1,2,5	19	1,3	3
11	5	21	1	18	1,2,3,4	2
12	7	1,2,3,4	5	9	1,3,4	2
13	2,3,4,5	1,4,5	7	5	1,3,5	1,2,3,4,5

14	2,3,5	3,4,5	3	1,2,3,4	1,2,3,5	4
15	1,2,3,4,5	1	1,2,3,5	5	2	4,5
16	1,2,3,4,5	1,2,4	3	3	4	2
17	2,4,5	3	3	5	7	1,2,3,5
18	8	1	3	3	8	1,2,3,5
19	10	4	1,2	10	1,2,3,4	2
20	7	3	9	1,2,3,5	1,2,3,5	4
21	4	1,2,4,5	4	2	5	2
22	1,2,3,4	4	6	3	3	1,4
23	1,2,4,5	2	1,5	4	6	1,3
24	4	1	1,5	4	1,2,3,5	1,3,5
25	2	4,5	2	1	1,2,3,5	3

Answers to situational tasks

2.1. The carotid tubercle (tuberculum caroticum) is the anterior tubercle of the transverse process of the VI cervical vertebra. You can press the common carotid artery to it at the level of the middle of the neck anterior to the sternocleidomastoid muscle.

2.2. No. Such lines are detected in children in places of sacral vertebrae fusion (temporary synchondrosis). They consist of cartilage that does not trap X-rays.

2.3. No, it does not. Most likely this was the consequence of the unsuccessful landing. A compression fracture of the 5th thoracic vertebra body can be assumed, because a decrease in the height of the vertebral body is one of the signs of such pathology.

3.1. A peripheral clavicle fragment, when displaced, can press the subclavian artery to the upper surface of the first rib, because it adheres to it, forming a groove (groove for subclavian artery).

3.2. Most likely, when the fracture is localized in the middle third of the humerus, because the radial nerve, located in the sulcus nervi radialis directly on the bone, can be restrained between its fragments, or cut by their sharp edges.

3.3. No. Sometimes between the scaphoid and capitate bones there is an additional bone called the central bone. This is a variant of the norm. To exclude or confirm the damage, it is necessary to perform an X-ray of the right hand in the same projection.

4.1. Through the greater trochanter.

4.2. No. At the age of 15, such lines of enlightenment can correspond to the areas of the cartilage tissue (temporary synchondrosis of the pelvic bone) between the bodies of the ileum, pubic and ischial bones. For control, it is needed to perform an X-ray of the right side of the pelvis and make sure there are such lines of enlightenment on the intact side, as well as between the branches of the sciatic and pubic bones.
4.3. The patient has signs of a left calcaneus closed fracture. To confirm the diagnosis, an X-ray examination is to be performed. Therefore, the patient must be delivered to a hospital and her left lower limb needs to be immobilized before transportation.
5.1. The inner plate of the compact substance of the skull is thin (it is sometimes called the vitreous plate). In case of an injury, a fracture of the inner plate of the compact substance of the skull is possible.
5.2. To the frontal sinus, this has a connection with the nasal cavity.
5.3. Destruction of the upper wall is the most dangerous, because the pituitary gland adjoins it.
6.1. The facial nerve passes in the canal along the medial wall of the tympanic cavity. The stapedius nerve and the nerve “chorda tympani” go from the facial canal into the tympanic cavity. In case of a chronic inflammation of the middle ear, the inflammatory process can go into the facial canal through the openings and the facial nerve becomes inflamed.
6.2. At this level, the facial canal runs along the axis of the temporal bone pyramid, and therefore, the facial nerve located in it with this localization of the fracture can be damaged.
6.3. This line of enlightenment corresponds to the course of the mandibular canal.
7.1. The patient has the obstruction of the nasolacrimal duct located in the nasolacrimal canal, which opens into the inferior nasal meatus.
7.2. To the middle nasal meatus.
7.3. Ethmoid, because it is the least durable and it has holes through which the anterior cranial fossa communicates with the nasal cavity.
8.1. In the occipital bone. More reliably the line of this fracture can be seen in the vertical or oblique projection of the skull.
8.2. Yes. These are the anterior and posterior ethmoid openings through which the inflammatory process can spread into the orbital cavity, and when the process is neglected, pus can melt a very thin orbital plate of the ethmoid bone.

9.1. Dens of the II cervical vertebra within dislocation falls behind the transverse ligament and can compress the spinal cord and the medulla oblongata.
9.2. Anterior longitudinal ligament.
9.3. No, because the specific strength of the masticatory muscles is very high and the head of the lower jaw will not be able to spontaneously shift posteriorly into the mandibular fossa, i.e. go around the articular tubercle. The patient needs specialized medical care.
10.1. Closed dislocation of the left shoulder. In the absence of other injuries, the injured person will maintain his hand in a comfortable position until delivery to the place of a specialized care.
10.2. Abduction and adduction movements of the elbow joint are impossible. The injured has a damage of the collateral ligaments of the elbow joint. It is important to immobilize the upper limb.
10.3. The axis of the trochlea is obliquely with the axis of the humerus. The forearm with the hand lays on the medial side of the chest during the flexion of the elbow joint.
11.1. Acromioclavicular and coracoclavicular ligaments.
11.2. Tibial collateral ligament injury. If man try to perform passive abduction of the leg, the pain in the ligament area will intensify.
11.3. Shopar's joint (tarsal transverse joint). First of all, a bifurcated ligament, which is the "key" of this joint, should be dissected.
12.1. Acromioclavicular and coracoclavicular ligaments.
12.2. This range of the motion is normal. Hand immobilization is not required.
12.3. No, it does not. This relative position of the shoulder and forearm suggests a fracture of the olecranon of the ulna. The immobilization is required.
12.4. No, it is not. The height of the articular cavity of the knee joint is 6 mm on X-ray. It corresponds to the total thickness of menisci, articular cartilage of the femur and the tibia.
12.5. Maybe, the collateral fibular ligament is injured. The fracture is the extraarticular fracture. The fibula does not participate in the formation of the knee joint.
13.1. The patient's head is tilted to the right side. The tilt and rotation of the head to the left is difficult. When he tilts the head backwards, it moves to the right. The trapezius muscle is also involved in tilting the head backwards. Its consistency can be checked when performing the movements of the scapula. The right transversospinales muscles participate in the rotation of the neck to the left side.

13.2. The patient has the trouble with the adduction, extention, and internal rotatation of the shoulder joint. The patient cannot pull his trunck upward and forwardr, because the left upper limb alone works at full force.
13.3. The rigth rhomboid muscles and rigth levator scapulae muscle do not work. The trapezius muscle is involved in the performance of these movements. It turns the head right backwards.
14.1. Fixing the shoulder girdle helps to include some additional respiratory muscles (pectoralis major muscle, pectoralis minor muscle, serratus anterior muscle) in the work.
14.2. The inguinal hernia.
14.3. The umbilical hernia.
14.4. The hernia of the white line.
14.5. The therapeutic exercises strengthen the abdominal muscles (rectus abdominis muscle, transverse abdominis muscle, internal and external oblique muscles.
15.1. The orbicularis oculi muscle and the frontal belly of the epicranius muscle on the left side of the face.
15.2. Corrugator supercilii muscle.
15.3. Left depressor anguli oris muscle.
15.4. Biting and chewing with the left side teeth is difficult. The lower jaw does not move to the sides. When trying to push the jaw forward, it moves to the left.
15.5. Pus from the upper (pharyngeal) part of the retrovisceral interfascial space spread to the posterior part of the mediastinum of the chest cavity, which led to the development of the mediastinal organs inflammation.
16.1. There is an infraspinatus muscle on the posterior surface of the scapula. The teres minor and teres major muscles are on the lateral edge of the scapula. If only the infraspinatus muscle is injured the functions of supination and adduction of the shoulder joint is weaken. If the teres minor muscle is also damaged, the supination of the shoulder is impossible. And when performing the abduction of the shoulder joint, its pronation also occur due to the function of the teres major, subscapularis and latissimus dorsi muscles. The rupture of the teres major muscle weakens the adduction and pronation of the shoulder joint.
16.2. In the relaxed (lowered) state, the right upper limb does not return to its typical position (the thumb of the hand is directed almost anteriorly, the palm of the hand is turned to the thigh), the functions of flexion, initial supination and pronation of the forearm are slightly reduced.

16.3. The pronator quadratus muscle was damaged.
16.4. On the anterior surface of the forearm along the synovial vagina of the flexor pollicis longus muscle.
16.5. On the anterior surface of the forearm along the common flexor sheath of the second, third, fourth, fifth fingers.
17.1. The sartorius muscle origins from the superior anterior iliac spine and inserts on the tibial tuberosity. It flexes the thigh and leg and supinates the thigh. The supination of the thigh, flexion of the thigh and shin were damaged.
17.2. All toes of the foot are in the position of the plantar flexion.The man cannot lift them, because the function of the extensor digitorum longus muscle, extensor digitorum brevis muscle, extensor hallucis longus muscle, extensor hallucis brevis muscle are damaged.
17.3. The extension and supination of the left hip joint is damaged.
17.4. The foot is in the full flexion position. Its toes are in the position of partial plantar flexion (the function of extensor digitorum brevis muscles are preserved). The lateral edge of the foot is raised.
17.5 The inflammatory process can spread no further than the level of the middle of the first metatarsal bone in the tendon sheath of the extensor hallicus longus. Because this tendon sheath is isolated.
18.1. This symptom testifies the absence of XII or more often XI ribs. There are eleven thoracic or six lumbar vertebrae.
18.2. Scoliosis. The most common cause may be poor posture.
18.3. Kyphosis. The reason may be an incorrect posture, congenital pathology of the vertebral column, metabolic disorders.
18.4. No, since this line of enlightenment corresponds to the cartilage location, which is ossified by the age of 12-22 years.
18.5. No, since this line of enlightenment corresponds to the zone of the epiphyseal cartilage, which is ossified by the age of 15-25 years.
18.6. There is the additional (Vesalius) bone in this place. This is a variant of norm. X-ray of the other foot is required to confirm it.
18.7. It may be a suture between two halves of the frontal bone, which usually grow together by the age of 2 years, or may remain constant (metopic suture).
18.8. The anomaly developed due to non-fusion of the palatine ridges of the right and left maxillary processes during embryonic development.
18.9. Intra-articular (when the fracture line is within the joint cavity) can be a fracture of the anatomical neck, because in its region, the joint capsule of the shoulder joint is attached. The surgical neck is removed from the joint cavity.

19.1. A sternocleidomastoid muscle is attached on the proximal end of the clavicle, due to the contraction of which the central (proximal) fragment is displaced up and back.

The subclavian muscle pulls the clavicle downward, and the deltoid muscle pulls the clavicle downward and forward. They are attached to the distal end of the clavicle. In addition, mass of the free upper limb pulls the clavicle downward and forward. Therefore, the peripheral (distal) fragment of the clavicle is shifted forward and downward.

19.2. The injured cannot turn his shoulder joint outwards. Because the origin of the infraspinatus muscle and teres minor is the greater tuberle.The abduction of the shoulder joint is also weakened because the origin of the supraspinatus muscle is torn off.

19.3. The injured cannot turn his shoulder joint inwards. The origin of the teres minor muscle, subscapular muscle and latissimus dorsi muscle is on the lesser tubercle of the humerus. If the lesser tubercle is fractured the shoulder join cannot pronates and adducts the shoulder joint.

19.4. The fracture line is located above the origin of the pectoralis major muscle. The teres minor muscle, supraspinatus muscle, and infraspinatus muscle originate from the greater tubercle of the humerus. They rotated outward the proximal fragment of humeus. The deltoid muscle pulls upward of the peripheral fragment of the humerus. The coracobrachial and long head of the triceps brachii muscles pull it up and inwards. The pectoralis major muscle addacts and rotates inwards.

19.5. The fracture line is located between the origins of the pectoralis major and deltoid muscles. The pectoralis major muscle and latissimus dorsi muscle originate from crests of the greater and lesser tubercles of the humerus. They displace the central fragmen to back and inwards. The peripheral fragment is displaced by the deltoid muscle up and outward. The coracobrachial muscle and long head of triceps brachii pull it up.

19.6. The distal fragment was displaced to back due to the traction of the shin muscles which origin from the posterior surface above the lateral and medial condyles. The displacement of the proximal fragment inside occurs due to the traction of the adductor muscles.

19.7. The serratus anterior muscle is supplied by the long thoracic nerve and abducts the right arm above the horizontal level.

19.8. The patient bends the head to the right side and turns the face toward the opposite side. The left shoulder girdle and clavicle are lowered. The upper edge of the scapula is turned outward.
19.9. M. orbicularis oris, m. mentalis.
19.10. The foot and toes are in the position of plantar flexion (there is no tonus of the anterior muscles of the leg and dorsal muscles of the foot.) The lateral edge of the foot is lowered (there is no tonus of the peroneal muscles) and turned inward.

References

The main literature**:**

1. Sapin, M. R. Textbook of human anatomy : for medical students : in 2 vol. Vol. 1 : / M. R. Sapin, L. L. Kolesnicov, D. V. Nikitjuk ; edited by M. R. Sapin. - Moscow : New Wave Publishing Agency, 2020. – P. 3-305 (and other publications).
2. Атлас анатомии человека / Р.Д. Синельников, Я.Р. Синельников А.Я. Синельников.– М.: РИА «Новая волна», 2020.– Том.1.– С. 7-93, 234-240 (and other publications).
3. Неттер Ф. Атлас анатомии человека.–М.: ГЭОТАР-Медиа, 2015. –624 с (and other publications).
4. Anatomy of the musculoskeletal system /Околокулак Е.С., Волчкевич Д.А., Гаджиева Ф.Г.– Гродно: ГрГМУ, 2018.– 288 с.

Additional:

5. Chaurasia, B. D. Human Anatomy : Regional and Applied. Dissection and Clinical. Vol. 1: Upper Limb, Thorax / B. D. Chaurasia ; chief ed. K. Garg ; ed. P. S. Mittal, M. Chandrupatla. - New Delhi : CBS Publishers & Distributors Pvt Ltd, 2015. – P. 2-31, 42-46,59-72,78,88-89,95-97,103-108,112-119,131-136,140-161,187-214 (and other publications).
6. Chaurasia, B. D. Human Anatomy : Regional and Applied. Dissection and Clinical. Vol. 2 : Lower limb, Abdomen & Pelvis./ B. D. Chaurasia ; chief ed. K. Garg ; ed. P. S. Mittal, M. Chandrupatla. - New Delhi : CBS Publishers & Distributors Pvt Ltd, 2015. – P. 3-39,44-48,52-61,66-72,77,82-86,92-95,98-102,104-108,114-120,136-164,183-190,202-218,341-343 (and other publications).
7. Chaurasia, B. D. Human Anatomy : Regional and Applied. Dissection and Clinical. Vol. 3: : Head-Neck & Brain / B. D. Chaurasia ; chief ed. K. Garg ; ed. P. S. Mittal, M. Chandrupatla. - New Delhi : CBS Publishers & Distributors Pvt Ltd, 2015. – P. 6,8,11,16-17,50-56,66-75,77-85,150-151,204-206 (and other publications).

Applications

A.

List of the questions from the section "Anatomy of locomotor apparatus" to be included in the examination cards for supervising the state examination on Human Anatomy for speciality 1 79 01 01 (General Medicine)

Section I. General theoretical questions

1. Subject and contents of anatomy. Place of anatomy in a number of biological disciplines. Modern methods and principles of anatomical research (investigations).
2. Anatomy and clinic. Significance of anatomical knowledge for the comprehension of mechanisms of diseases development , their diagnostics, treatment and prevention.
3. Personal variability of organs. Variants of the norm and abnormalities of the organism and organs as a whole. Types of body.
4. Early stages of the human embryonic development. Germinal layers and their derivatives.
5. Anatomy in Belarus. Golub and his school. Scientific course of investigations for Belorussian anatomists.

Section II. Anatomy of locomotor apparatus

1. Bone as an organ: development, structure, and growth. Classification of bones. Types of ossification.
2. Chemical composition and physical properties of the bone.
3. Development of the axial skeleton during ontogenesis. Vertebral column as a whole. Variants of structure and abnormalities.
4. Development of the upper limb during ontogenesis. Variants of structure and abnormalities of development. The upper limb as an organ of labour.
5. Development of the lower limb during ontogenesis. Variants of structure and developmental anomalies of the lower limb as an organ of locomotor system.
6. Development of the skull during ontogenesis. Visceral arches and their derivatives. Age, sex and personal features of the skull.
7. Anatomical and biomechanical classification of the junctions between bones.
8. Structure of the joint, its main and accessory elements. Classification of joints according to their structure, shape of articulating surfaces and function (action).
9. Skeletal muscle as an organ. Development, classification, functions of skeletal muscles. The accessory apparatus of muscles.
10. Action of muscles. An osteo-muscular system as a system of levers of the Ist and IInd types.
11. The vertebrae: structure of different parts of vertebrae in the vertebral column. Joints between vertebrae, blood supply and nerve supply.
12. Vertebral column as a whole. Its parts, structure, vertebrall curvatures, and movement. Muscles, which make movement of the vertebral column, its blood supply and innervation.

13. Anatomy of the breast bone (sternum) and ribs. Articulations between the ribs and the breast bone, costovertebral joints. Muscles to make movement of the ribs, their blood and nerve supply.
14. Thoracic cage as a whole: structure, its individual and typological features, functions.
15. Joints between the vertebral column and the skull. Muscles that make movement of the head, their blood supply and innervations.
16. The structure of bones of neurocranium: occipital, frontal, parietal and ethmoid.
17. Cranial suturae.
18. The sphenoid bone: structure, foramens (openings) and its contents.
19. The temporal bone: structure, canals and its contents.
20. The anatomy bones of the visceral cranium: development, structure.
21. The external surface of the base of the skull (basis cranii externa): structure, opening and their contents. Temporal and infratemporal fossa, and its contents.
22. The internal surface of the base of the skull (basis cranii interna): structure, foramens and its contents.
23. Anatomy of the nose and paranasal sinuses: structure, functions, blood supply and nerve supply.
24. The orbits: structure, openings and its contents.
25. The pterygopalatine fossa: structure, openings and contents.
26. The joints between the bones of skull. The temporomandibular joint: structure, shape and movement.
27. Anatomy of bones of the shoulder girdle, joints, blood supply and innervations. Peculiarities structure of bones the shoulder girdle.
28. Anatomy of the shoulder and forearm bones,their blood supply and nerve supply.
29. Anatomy of the bones of the hand, their blood supply and nerve supply.
30. The shoulder joint: structure, shape and movement. Anatomy of the muscles to make movement of the shoulder joint, blood supply and nerve supply.
31. The elbow joint: structure, shape, and movement. Anatomy of the muscles to make movement of the elbow joint, blood and nerve supply.
32. The joints of the forearm: structure, shape and movement. Muscles to make movement in this joint, blood supply and innervations.
33. The radiocarpal joint: structure, shape, and movement. Muscles to make movements in this joint, blood supply and nerve supply.
34. Joints of the hand: structure, shape, and movement. Muscles to make movemens in this joint, their blood supply and nerve supply.
35. The hand as a whole: structure, parts and hard foundation of the hand, joints of the hand. Particular features of the hand, as an organ of labour.
36. Anatomy of the topographical structures of the pelvis, their contents.
36. Anatomy of bones of pelvic girdle, their blood supply and innervation.
37. Anatomy of bones of the femur and leg, their blood supply and nerve supply.
38. Anatomy of bones of the foot, their blood supply and nerve supply.
39. Anatomy of the hip bones. Pelvis as a whole. Features of the female pelvis and its measurements.

40. The hip joint: structure, shape, movements. Anatomy of muscles to make motion in hip joint, their blood supply and innervation.
41. The knee joint: structure, shape and movement. Muscles to produce movement in this joint, their blood supply and i nerve supply.
42. The ankle joint: structure, shape, and movement. Muscles to produce movement in this joint, their blood supply and nerve supply.
43. Joints of foot: structure, shape and movement. Muscles to produce movement in the joint of foot, their blood supply and nerve supply.
44. Foot as a whole: parts, bony structure of the foot. Arches of the foot and mechanisms of their strengthening. Surgical joints of the foot.
45. The comparative characteristic of the skeleton, joints and muscles of the upper and lower limbs.
46. Muscles of facial expression: structure, functions, blood supply and nerve supply.
47. Muscles of mastication: structure, function, fasciae, blood supply and nerve supply.
48. Muscles of the neck: group and individual characteristic, functions, blood supply, innervation.
49. Topography and fasciae of the neck. The interfascial spaces of the neck, their clinical value
50. Muscles and fasciae of the chest: topography, structure, functions, blood supply and innervation.
51. Diaphragm as an organ: structure, parts, functions, foramens and its contents. Blood supply, innervation of the diaphragm.
52. Muscles of the abdomen: classification, structure, functions, blood supply and innervation.
53. Abdominal prelum: anatomy and functions. Linea alba. The sheath of the rectus muscle.
54. The inguinal canal: topography, walls, foramenae and its contents. Week places of the abdominal wall.
55. Muscles and fasciae of the shoulder girdle: structure, functions, blood supply, innervation.
56. Muscles and fasciae of the arm structure, functions, blood supply, innervation. Grooves of the arm and its contents.
57. Muscles and fasciae of the forearm: structure, functions, blood supply and innervation. Grooves of the forearm and its contents.
58. Muscles of the hand: classification, functions, blood supply, innervation.
59. Anatomy of the axillary region: fossa, cavity, foramenae and triangles. The humeromuscular canal and its contents.
60. Osteo-fibrous canals and sinovial vaginae (tendon sheaths) of the foot, their contents.
61. Muscles and fasciae of the pelvic girdle: structure, functions, blood supply, innervation.
62. Muscles of the thigh: classification, structure, functions, blood supply, innervation.
63. Muscles of the leg: classification, structure, functions, blood supply, innervation.
64. Muscles of the foot: classification, structure, functions, blood supply, innervation.

65. Anatomy of the pelvis' topographic formations, their contents.
66. Femoral canal: topography, walls, foramenae and clinical value. Anatomy of the saphenous opening, its clinical value.
67. Anatomy of the topographical structures of the thigh: compartments, grooves (sulci), adductor canal, their contents.
68. Anatomy and contents of the popliteal fossa. Topographical structures of the leg and their contents.
69. Osteo-fibrous canals and synovial vaginae (tendon sheaths) of the hand and its contents.
70. The pelvic diaphragm: structure, functions, blood supply, innervation. An ischio-anal fossa and its contents.
71. Pelvic diaphragm: structure, functions, blood supply, innervation.

B.

Criteria for knowledge assessment and competence of students. Educational discipline “Human Anatomy”

10 graid:

- systematized, profoun and full knowledge of all divisions of the syllabus and basic questions which are outside the scope of the syllabus; demonstration of the organs and structures which have been previously studied in the frames of the theme, details of their structure on preparations, plaster casts, roentgenograms, tomograms;
- correct usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer;
- irreproachable skill of the dissection technique and work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to read the roentgenograms, tomograms according to algorithm;
- represented ability to handle with complex problems and non-standard situations independently and constructively;
- full and profound mastering of basic and additional literature recommended by the educational program of the discipline;
- skill to orientate oneself in theories, conceptions and directions of the studied discipline and to give a critical valuation, to use scientific achievements of other disciplines;
- ability to represent graphically (sketchily) the basic stages of the organs development and systems of organism, formation of anomalies and deformities; knowlege basic causes of their occurrence;
- creative independent work at laboratory classes, electives and during self-preparation to classes, participation in SRWS (Scientific Research Work of Students) and ARWS (Academic Research Work of Students) on problems of anatomy, active participation in group discussions, absence of violations of deontological and sanitary-hygienic rules of work with anatomical preparations, a high level of culture of task completion.

9 grade:

-systematized, profound and full knowledge of all divisions of the educational syllabus; demonstration of the organs and structures to have been previously studied with the frames of the topic, details of their structure on preparations, plaster casts, roentgenograms, tomograms;

- correct usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer;

- skill of the dissection technique and work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to read the roentgenograms, tomograms according to the algorithm;

- ability to handle with complex problems and non-standard situations independently and constructively;

- full and profound mastering of basic and additional literature recommended by the educational program on the discipline;

- skill to orientate oneself in theories, conceptions and directions of the studied discipline and to give a critical evaluation;

- ability to represent graphically (sketchily) the basic stages of the organs development and systems of the organism, formation of anomalies and deformities; knowledge of basic causes of their occurrence;

- independent work at laboratory classes and during self-preparation to classes, active participation in group discussions, absence of violations of deontological and sanitary-hygienic rules of work with anatomical preparations, high level of culture of task completion.

8 grade:

-systematized, profound and full knowledge of all divisions of the educational program; demonstration of the organs and structures to have been previously studied within the frames of the topic, details of their structure on preparations, plaster casts, roentgenograms, tomograms;

- usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer, ability to make ones own conclusions;

- skill of the dissection technique and work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to read the roentgenograms, tomograms according to the algorithm;

- ability to handle with complex problems within the frames of educational syllabus independently;

- mastering of basic and additional literature recommended by the educational program of the discipline;

-ability to represent graphically (sketchily) the basic stages of the organs development and systems of the organism, formation of anomalies and deformities; knowledge of basic causes of their occurrence;

- independent work at laboratory classes and during self-preparation to classes, active participation in group discussions, absence of violations of deontological and

sanitary-hygienic rules of work with anatomical preparations, a high level of culture of task completion.

7 grade:

- systematized, profound and full knowledge of all divisions of the educational syllabus; demonstration of organs and structures to have been previously studied within the frames of the topic, details of their structure on preparations, plaster casts, roentgenograms, tomograms;
- usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer, ability to make one's own conclusions;
- skill of the dissection technique and work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to read the roentgenograms, tomograms according to the algorithm;
- ability to use typical solution within the frames of the educational syllabus independently;
- mastering of basic and additional literature recommended by the educational syllabus on the discipline;
- ability to represent graphically (sketchily) the basic stages of the organs development and systems of the organism, formation of anomalies and deformities;
- independent work at laboratory classes and during self-preparation to classes, periodic participation in group discussions, absence of violations of deontological and sanitary-hygienic rules of work with anatomical preparations, a high level of culture of task completion.

6 grade:

- sufficient systematized and full knowledge of the educational syllabus; demonstration of organs and structures to have been previously studied within the frames of the topic, details of their structure on preparations, plaster casts, roentgenograms, tomograms;
- knowledge of description of an organ structure (part of a body) in correspondence with program of text-books, course of lectures;
- usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer, ability to make one's own conclusions;
- skill of the dissection technique and work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to read the roentgenograms, tomograms according to algorithm;
- ability to use typical solutions in the frames of the educational syllabus independently;
- mastering of basic literature recommended by the educational syllabus of the discipline;
- ability to represent graphically (sketchily) the basic stages of the organs development and systems of the organism, formation of anomalies and deformities;
- independent work at laboratory classes and during self-preparation to classes,

periodic participation in group discussions, absence of violations of deontological and sanitary-hygienic rules of work with anatomical preparations, a high level of culture of task completion.

5 grade:

- sufficient knowledge of the educational syllabus;
- knowledge of description of the structure of an organ, topography of an organ (part of a body) in correspondence with the program of text-books, course of lectures, ability to remember small details of structure by means of directing questions of a teacher;
- usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer, ability to make one's own generalizations and conclusions by means of directing questions;
- skill of the dissection technique and work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to read the roentgenograms, tomograms according to the algorithm;
- ability to resolve standard (typical) tasks under the guidance of a teacher;
- ability to use typical solutionswithin the frames of the educational program independently;
- mastering of basic literature recommended by the educational program of the discipline;
- ability to represent graphically (sketchily) the basic stages of the organs development and systems of the organism, formation of anomalies and deformities;
- independent work at laboratory classes and during self-preparation to classes, rare participation in group discussions, absence of violations of deontological and sanitary-hygienic rules of work with anatomical preparations.

4 grade:

- sufficient knowledge in correspondence with an educational standard;
- knowledge of description of basic details of the structure and topography of an organ (part of a body) in correspondence with the program of a text-book;
- usage of scientific Latin and English (Russian) terminology, stylistically competent and logically correct representation of the answer by means of directing questions, failure to make one's own generalizations and conclusions;
- demonstration of the organs and structures within the frames of the educational program, basic details of their structure on preparations, plaster casts, tables;
- skill of work with anatomical instruments (tweezers, scalpel); ability to work with negatoscope and to recognize the roentgenograms, tomograms according to algorithm with correction of a teacher;
- failure to use standard (typical) solutions in educational tasks by means of directing questions of a teacher ;
- ability to represent graphically (sketchily) the basic stages of the organs development and systems of the organism, formation of anomalies and deformities with single corrections of a teacher;

- work at laboratory classes under the guidance of a teacher, rare participation in group discussions, permissible level of violations of deontological and sanitary-hygienic rules of work with anatomical preparations.

3 grade:

- insufficient knowledge of the organs in correspondence with an educational standard;
- knowledge of description of the structure of an organ (part of a body) in correspondence with program of a text-book;
- failure to represent graphically (sketchily) basic stages of the organs development and systems of organism, formation of anomalies and deformities;
- usage of scientific Latin and English (Russian) terminology with significant linguistic and logical mistakes;
- enumeration of the organs within the frames of the educational program, recognition on preparations, plaster casts, tablets, failure to place them in a correct way, failure to demonstrate knowledge of anatomy on natural preparations and moulages;
- incorrect usage of anatomical instruments (tweezers, scalpel), incompetence in deciding standard (typical) situational tasks;
- inactivity at laboratory classes;
- inadequate, squeamish attitude to natural anatomical preparations, violation of deontological and sanitary-hygienic rules of the work with anatomical preparations.

2 grade:

- fragmentary knowledge in correspondence with educational standard, knowledge with low level of understanding;
- enumeration of the organs within the frames of educational topic, without recognition on tables, moulages, preparations;
- incorrect usage of anatomical instruments (tweezers, scalpel); failure to decide standard (typical) situational tasks;
- incorrect usage of Latin and English (Russian) terms;
- inactivity at laboratory classes;
- inadequate, squeamish attitude to natural anatomical preparations, violation of deontological and sanitary-hygienic rules of the work with anatomical preparations.

1 grade:

- absence of knowledge and competence in correspondence with educational standard, distortion of sense of accounting question, failure to decide standard (typical) situational tasks, refuse to answer.

C.

The statute of the rating system

The statute of the rating system to estimate the knowledge of students (rating-plan) at the department of Human Anatomy while studying the discipline "Human Anatomy" for speciality 1-79 0101 – General Medicine (Faculty of Overseas Students Training)

A rating system of the department is the system of integral assessmentn of all types of studying activities on the academic discipline for students of the Medical Faculty and Faculty of Overseas Students Training.

The purpose of student's progress assessment rating system is complex estimating of a student's work quality in the discipline and educational program mastering. Estimation of academic work quality is expressed as a percentage of the maximum possible value of attendance and achievement of a student.

The following types of educational activity are estimated

• **lectures;**

• **laboratory studies;**

• **individual study** (classroom and extra curricular) demonstrating knowledge of the studied structures on the anatomical preparation, X-ray and tomograms at laboratory and final classes);

• **final classes on sections of the discipline,** demonstrating knowledge of the studied structures on the anatomical preparation

Educational process at the Department of Human Anatomy is organized in a modular pattern. The whole educational material is divided into the following structural logic modules (blocks, sections):

I semester

• Anatomy of Bones (skeletal system);

• Anatomy of Joints (articular system);

• Anatomy of Muscles (skeletal muscle system);

Semester credit

II Semester

• Anatomy of Internal organs;

• Anatomy of Cardiovascular System;

• Anatomy of Central Nervous System

Semester credit

III Semester

• Anatomy of Peripheral Nervous System;

• Anatomy of Endocrine Glands;

• Anatomy of Sense Organs and Human Integument;

Exam

The main forms of assessment:

• a written incoming control consisting of 10 questions on every laboratory work;

• oral recitation on anatomical specimens during laboratory studies;

• anatomical specimens knowledge assessment during 8 final classes (colloquiums) on every of 8 modules (3 – in the first semester, 3- in the second semester, 2- in the third semester);

• computer test assessmen before the exam;

• oral examination assessmen of practical skills;

• oral assessmen of knowledge on the exam.

Attendance of lectures and laboratory classes, as well as evaluation of current and final assessmen is recorded in lecture and academic journals.

The assessment of all types of activity is conducted based on the 10-grade scale according to the approved regulation.

Calculation to estimate the ranking mark of the test (at a laboratory class and pre-examinational) is cleared based on a scale approved by the Vice-rector of Educational Work and International Affairs. At the same time a positive result is above 70% of correct answers on all types of test assessmen. The scale of marks for the test assessmen answers is the following:

no correct answers – 0; less than 20 correct answers – 1; 40 and less correct answers – 2; 41-69 correct answers – 3; 70-74 correct answers – 4; 75-79 correct answers – 5; 80-84 correct answers – 6; 85-89 correct answers – 7; 90-94 correct answers – 8; 95-99 correct answers – 9; 100 correct answers - 10.

Under the curriculum during 3 semesters 19 lectures and 73 laboratory classes are provided. According to the plan 8 assessmen classes are carried out. The calculation of rating is done by multiplying each lecture (lesson) attendance and a class work mark for the appropriate coefficient.

The discipline rating consists of 9 components each of which has its own "weight" when calculating.

I. **Current rating**

1. Lectures attendance;

2. Laboratory class attendance

3. The total mark for laboratory studies preparation (test control);

4. The total mark for activity in laboratory class (takes into account the amount of 50% of the best positive marks of the total number of laboratory classes for the evaluated period: semester, the entire training period).

5. The sum of the marks for all final classes in all sections (modules) in the estimated period (semester, the entire period of study);

II. **Frontier rating**

Determined at the end of the last laboratory class of the semester, it includes the total points of all 5 components of the current rating for the semester. A set of a minimum (and higher) amount of points is the basis for setting a credit in the credit book

III**. Creativity rating (**T).

IV. Reward mark. The regularity of independent out-of-class work may give the student up to 1 point (if they studying every week on the specimens).

Final rating

It determined at the end of the last laboratory class of the third semester, which includes: current rating+ frontier rating+ creativity rating+ reward mark + mark for the exam testing;

The table of work executed coefficients in studying the subject "Human Anatomy" for speciality 1- 79 01 01- General Medicine in the Faculty of Overseas Students Training.

№	Types of work	Coefficient	The maximum score for the whole course (3 semester)
1	Lecture attendance	0,06	1,14 (19x0,06)
2	Laboratory class attendance	0,06	4,38 (73x0,06)
3	Test assessment (multiplication of a mark with coefficient (MxCQ))	0,01	7,3(73x10x0,01)
4	Final mark for practical skills control (MxCQ)	0,08	25,6 (32(=8+16+8)x10x0,08)
5	Estimations of anatomy preparations knowledge on the final class (colloquium) (MxCQ)	0,4	36,0 (9x10x0,4)
Total - 70,42 (Maximal mark based on the current and intermediate assessment)			
6	Examination testing (MxCQ)	0,2	2
Total deal student - Total - 72,42 (The maximal sum of marks based on the current, intermediate and final assessment)			

The student will not get 0,06 points for the missing class. For disciplinary influence the 1st -2 nd courses students who are late for a laboratory class or (lecture) will loose some points. In this case the coefficient for attendance will be 0,03 (instead of 0,06).

At working out the missing lectures and laboratory classes a student gets an assessment, which is put onto the appropriate check box of the academic journal and taken into account in rating.

Unsatisfactory marks at modular frontier final classes can be corrected until getting a positive mark. As a student's willing, it is possible to correct (by working out) current unsatisfactory (1-3) mark for the laboratory class. A mark for test assessment on laboratory class cannot be worked out or corrected.

The creative rating of a student can include the following kinds of activityes:

• preparation of abstract concerningthe development and the abnormality of the body and the organs systems, and reading it on the group lesson - 0,5 point (T1);

• making educational anatomical specimens - 3 points (T2);

• making a chart A1 - 0,5 points (T3);

• making a museums anatomical specimens - 10 points ((T4);

• restoration the museum anatomical preparation -3 points ((T5);

• making a multimedia presentation in Power Point which includes not less than 50 slides, 30 images and 5 pages of text basing on a lecture -2 points for each presentation (T6);

• participation in a Students Scientific Society meetings - 0,5 points for each meeting (T7);

• speaking at a Students Scientific Society meetings – 0.5 points per report (T8)

• reporting at the Scientific Society meetings his researching -2 points for each report (T9);

• reporting at the conference with the following publication in the form of abstracts or articles in the collection - 4points for one report or article); (T10);

• participation in the Republican show-contest of students' research papers - 10 points for a paper (T11).

• participation in the anatomy olympiad:

a) in the VSMU- 4 points for first place, 3 - for second place, 2 - for third place (the rest for participation 1 point when gaining more than 30%, and 0.5 points – when gaining less than 30%)

b) republican: 10 points for first place, 9 - for second place, 8 - for third place. (6 points for participation

c) international: 14 points for first place, 13 - for second place, 12 - for third place (10 points for participation) (T12).

Creativity rating is not compulsory for a student. Its result is added to the rating assessment after the answers at the exam, only if there are no academic frontier and final (examination) debts.

Intermediate rating of the semester (IR)-is calculated as the sum of components taking into account ": IR = Ax0,06 + (Bx 0,06 - Cx0,03) + Dx0,01 + Ex0,08 + Fx0,4

A – a number of attended lectures;

B – a number of attended laboratory classes;

C – a number of coming late for laboratory classes;

D – s sum of marks for laboratory tests;

E –s sum of 50 % of the best positive marks for demonstrating knowledge of the studied structures on the anatomical preparation

F – s sum of marks for the final classes (colloquiums on modules);

The discipline rating (Rd) is calculated as the sum of the ratings for 3 semesters taking into account their "weight": Rd=Rs1+Rs2+Rs3 + Gx0,2 + T (T1 + T2 + T3 + T4 + T5 + T6 + T7 + T8 + T9 + T10 + T11+T12)+Rm regularity of independent out-of-class work may give the student up to 1 point (if every week preparation for the specimens)

Rs- the semester rating

G - a mark for the exam test;

T - rating of creativity.

Rm-reward mark

As a result of the curriculum completing a student can get collect:

I semester - Pmax = 21.92 points, (if there are no missing classes, lectures and sum of 8 best marks) «10»), Pmin = 9,74 points (if there are no missing classes, lectures and sum of 8 positive marks (32). If a student has a positive mark (4 and bove) in all 3 final classes and the total rating is P≥9,6 he will get credit.

II semester - Pmax = 30.98 points, Pmin = 13,6 points (there are no missing classes and sum of 16 best marks «10»). If a student has 16 positive mark, 4 and above (sum of 16 positive mark in laboratory classes ≥64), and sum of all 3 final classes≥12) and the total rating is P ≥ 13,6 he will get credit.

III semester - Pmax = 17.52 points, Pmin = 7,8 points (there are no missing classes and lectures, the sum of the 8 best positive marks for the demonstration of structures in specimens in the current classes 32). If a student has a positive mark (4 and above) in all 3 final classes and the total rating is P≥7,6 will get credit.

A student can be allowed for the exam if he attended all laboratory classes and lectures and has positive marks (4 and above) in all 8 final classes, credits in 3 semesters and the total rating of P ≥ 31.48*

After passing the exam a student get a mark on 10-point system into his credit book depending on the rating in accordance with the following scale:

Rating score	Mark on the 10-point system
70,42 and above	10
63,93 - 70,41	9
57,44 – 63,92	8
50,95 - 57,43	7
44,46 – 50,94	6
37,97 - 44,45	5
31,48 - 37,96	4

The total rating - is the average result of the sum of rating score and marks which a student received at the examination for an oral interview and practical skills. This mark is set down into the credit book.

Rtotal. = (Rcre. + P sk +O): 3.

R to= total rating

R cre= rating score

P sk= practical skills

O is= oral interview

The students can be relased from the exam, according to the vice-rector's order.

Учебное издание

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Work Book in Human Anatomy. **Locomotion apparatus**

Textbook

Практикум по анатомии человека. Опорно-двигательный аппарат

Учебное пособие

Редактор А.К. Усович

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